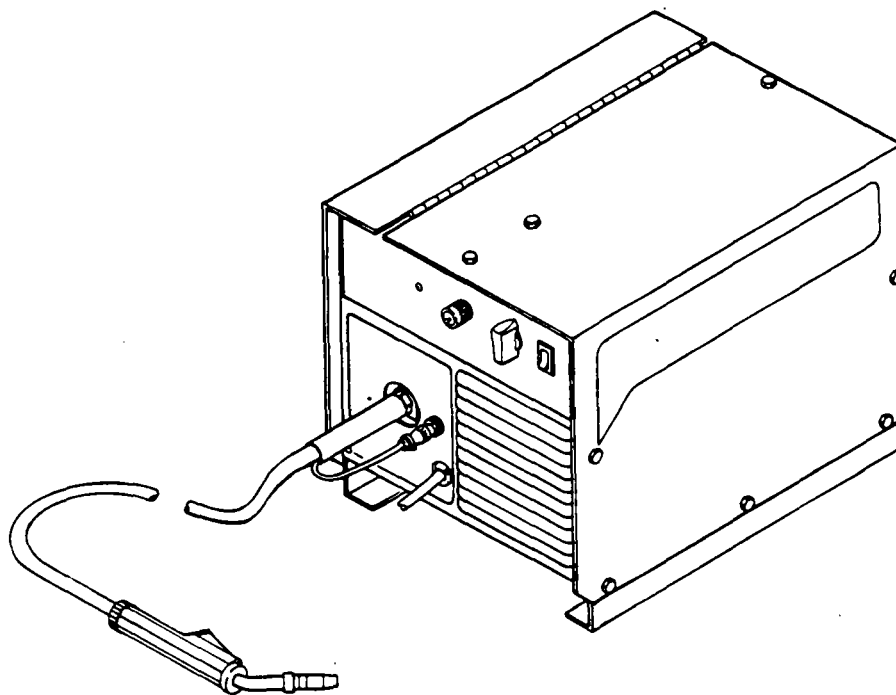


AUTO ARC[®]

September 1990 FORM: OM-112 875D

Effective With Serial No. KA870779

MODEL: MW 4110
MW 4230



OWNER'S MANUAL

IMPORTANT: Read and understand the entire contents of this manual, with special emphasis on the safety material throughout the manual, before installing, operating, or maintaining this equipment. This unit and these instructions are for use only by persons trained and experienced in the safe operation of welding equipment. Do not allow untrained persons to install, operate, or maintain this unit. Contact your distributor if you do not fully understand these instructions.

MILLER ELECTRIC Mfg. Co.
A Miller Group Ltd., Company

P.O. Box 1079
Appleton, WI 54912 USA
Tel. 414-734-9821

ONE YEAR LIMITED WARRANTY

EFFECTIVE: FEBRUARY 17, 1989

This warranty supersedes all previous AUTO ARC warranties and is exclusive with no other guarantees or warranties expressed or implied.

COVERAGE - MILLER Electric Mfg. Co. warrants to the buyer who purchases this AUTO ARC Welder ("Welder") for personal, family or household purposes ("Consumer") that this Welder will be free from defects in material and workmanship for a period of one year from the date of purchase. This warranty covers only the original purchaser of this Welder. MILLER Electric does not authorize any party, including its authorized distributors, to offer any other warranty on behalf of MILLER Electric. Upon expiration of the warranty period, MILLER Electric shall have no further liability related to the Welder, except on warranty claims made during the warranty period. No warranty is made by MILLER with respect to engines, trade accessories or other items manufactured by others. Such engines, trade accessories and other items are sold subject to the warranties of their respective manufacturers, if any. All engines are warranted by their manufacturer for two years from date of original purchase, except Deutz engines which have a one year, 2000 hour warranty.

MILLER shall be required to honor warranty claims on warranted Equipment in the event of failure resulting from a defect within the following periods from the date of delivery of Equipment to the original user:

1. Arc welders, power sources, and components . . . 1 year
2. Original main power rectifiers 3 years (labor - 1 year only)
3. All welding guns, feeder/guns and torches 90 days
4. Replacement or repair parts, exclusive of labor . 60 days
5. Batteries 6 months

provided that MILLER is notified in writing within thirty (30) days of such failure.

WHAT IS NOT COVERED - This warranty does not extend to any Welder subjected to misuse, neglect, accident, or in-warranty repair by anyone except MILLER Electric or its authorized service stations. Further, this warranty only extends to the original purchaser of this Welder.

In the case of MILLER's breach of warranty or any other duty with respect to the quality of any goods, the exclusive remedies therefore shall be, at MILLER's option (1) repair or (2) replacement or, where authorized in writing by MILLER in appropriate cases, (3) the reasonable cost of repair or replacement at an authorized MILLER service station or (4) payment of or credit

for the purchase price (less reasonable depreciation based upon actual use) upon return of the goods at Consumer's risk and expense. MILLER's option of repair or replacement will be F.O.B., Factory at Appleton, WI or F.O.B. at a MILLER authorized service facility, therefore, no compensation for transportation costs of any kind will be allowed. Upon receipt of notice of apparent defect or failure, MILLER shall instruct the claimant on the warranty claim procedures to be followed.

THIS WARRANTY IS OFFERED IN LIEU OF ANY OTHER EXPRESS WARRANTY; AND, EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW, THE DURATION OF ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, IS LIMITED TO THE DURATION OF THIS WARRANTY.

ANY EXPRESS WARRANTY NOT PROVIDED HEREIN AND ANY IMPLIED WARRANTY, GUARANTY OR REPRESENTATION AS TO PERFORMANCE, AND ANY REMEDY FOR BREACH OF CONTRACT WHICH, BUT FOR THIS PROVISION, MIGHT ARISE BY IMPLICATION, OPERATION OF LAW, CUSTOM OF TRADE OR COURSE OF DEALING, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR PARTICULAR PURPOSE, WITH RESPECT TO ANY AND ALL EQUIPMENT FURNISHED BY MILLER IS EXCLUDED AND DISCLAIMED BY MILLER.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

THE PURCHASER'S REMEDIES FOR A DEFECTIVE WELDER, TO THE EXTENT PERMITTED BY APPLICABLE LAW, ARE LIMITED TO THE REMEDY PROVIDED BY THIS WARRANTY. TO THE EXTENT ENFORCEABLE UNDER APPLICABLE LAW, MILLER ELECTRIC SHALL IN NO EVENT BE LIABLE FOR CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES ARISING OUT OF THE USE OF, OR INABILITY TO USE, THE WELDER, WHETHER BASED ON BREACH OF THIS WARRANTY, MILLER ELECTRIC'S NEGLIGENCE OR OTHER TORT, OR ON ANY THEORY OF STRICT LIABILITY.

RECEIVING-HANDLING

Before unpacking equipment, check carton for any damage that may have occurred during shipment. File any claims for loss or damage **with the delivering carrier**. Assistance for filing or settling claims may be obtained from the distributor and/or the equipment manufacturer's Transportation Department.

When requesting information about this equipment, always provide the Model Description and Serial or Style Number.

Use the following spaces to record the Model Designation and Serial or Style Number of your unit. The information is located on the data card or the nameplate.

Model _____

Serial or Style No. _____

Date of Purchase _____

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SECTION 1 – SAFETY RULES FOR OPERATION OF ARC WELDING POWER SOURCE

1-1. INTRODUCTION

We learn by experience. Learning safety through personal experience, like a child touching a hot stove is harmful, wasteful, and unwise. Let the experience of others teach you.

Safe practices developed from experience in the use of welding and cutting are described in this manual. Research, development, and field experience have evolved reliable equipment and safe installation, operation, and servicing practices. Accidents occur when equipment is improperly used or maintained. The reason for the safe practices may not always be given. Some are based on common sense, others may require technical volumes to explain. It is wiser to follow the rules.

Read and understand these safe practices before attempting to install, operate, or service the equipment. Comply with these procedures as applicable to the particular equipment used and their instruction manuals, for personal safety and for the safety of others.

Failure to observe these safe practices may cause serious injury or death. When safety becomes a habit, the equipment can be used with confidence.

These safe practices are divided into two Sections: 1-General Precautions, common to arc welding and cutting; and 2-Arc Welding (and Cutting) (only).

Reference standards: Published Standards on safety are also available for additional and more complete procedures than those given in this manual. They are listed in the Standards Index in this manual. ANSI Z49.1 is the most complete.

The National Electrical Code, Occupational Safety and Health Administration, local industrial codes, and local inspection requirements also provide a basis for equipment installation, use, and service.

1-2. GENERAL PRECAUTIONS

Different arc welding processes, electrode alloys, and fluxes can produce different fumes, gases, and radiation levels. In addition to the information in this manual, be sure to consult flux and electrode manufacturers Material Safety Data Sheets (MSDSs) for specific technical data and precautionary measures concerning their material.

A. Burn Prevention

Wear protective clothing-gauntlet gloves designed for use in welding, hat, and high safety-toe shoes. Button shirt collar and pocket flaps, and wear cuffless trousers to avoid entry of sparks and slag.

Wear helmet with safety goggles and glasses with side shields underneath, appropriate filter lenses or plates (protected by clear cover glass). This is a MUST for

welding or cutting, (and chipping) to protect the eyes from radiant energy and flying metal. Replace cover glass when broken, pitted, or spattered. See 1-3A.2.

Avoid oily or greasy clothing. A spark may ignite them.

Hot metal such as electrode stubs and workpieces should never be handled without gloves.

Medical first aid and eye treatment. First aid facilities and a qualified first aid person should be available for each shift unless medical facilities are close by for immediate treatment of flash burns of the eyes and skin burns.

Ear plugs should be worn when working on overhead or in a confined space. A hard hat should be worn when others work overhead.

Flammable hair preparations should not be used by persons intending to weld or cut.

B. Toxic Fume Prevention

Severe discomfort, illness or death can result from fumes, vapors, heat, or oxygen enrichment or depletion that welding (or cutting) may produce. Prevent them with adequate ventilation as described in ANSI Standard Z49.1 listed in Standards Index. NEVER ventilate with oxygen.

Lead -, cadmium -, zinc -, mercury -, and beryllium-bearing and similar materials, when welded (or cut) may produce harmful concentrations of toxic fumes. Adequate local exhaust ventilation must be used, or each person in the area as well as the operator must wear an air-supplied respirator. For beryllium, both must be used.

Metals coated with or containing materials that emit toxic fumes should not be heated unless coating is removed from the work surface, the area is well ventilated and, if necessary, while wearing an air-supplied respirator.

Work in a confined space only while it is being ventilated and, if necessary, while wearing an air-supplied respirator.

Gas leaks in a confined space should be avoided. Leaked gas in large quantities can change oxygen concentration dangerously. Do not bring gas cylinders into a confined space.

Leaving confined space, shut OFF gas supply at source to prevent possible accumulation of gases in the space if downstream valves have been accidentally opened or left open. Check to be sure that the space is safe before re-entering it.

Vapors from chlorinated solvents can be decomposed by the heat of the arc (or flame) to form PHOSGENE, a highly toxic gas, and other lung and eye irritating products. The ultraviolet (radiant) energy of the arc can also decompose trichloroethylene and perchloroethylene vapors to form phosgene. DO NOT WELD or cut where solvent vapors can be drawn into the welding or cutting atmosphere or where the radiant energy can penetrate to

atmospheres containing even minute amounts of trichloroethylene or perchloroethylene.

C. Fire and Explosion Prevention

Causes of fire and explosion are: combustibles reached by the arc, flame, flying sparks, hot slag or heated material; misuse of compressed gases and cylinders; and short circuits.

BE AWARE THAT flying sparks or falling slag can pass through cracks, along pipes, through windows or doors, and through wall or floor openings, out of sight of the goggled operator. Sparks and slag can fly 35 feet.

To prevent fires and explosion:

Keep equipment clean and operable, free of oil, grease, and (in electrical parts) of metallic particles that can cause short circuits.

If combustibles are in area, do NOT weld or cut. Move the work if practicable, to an area free of combustibles. Avoid paint spray rooms, dip tanks, storage areas, ventilators. If the work cannot be moved, move combustibles at least 35 feet away out of reach of sparks and heat; or protect against ignition with suitable and snug-fitting, fire-resistant covers or shields.

Walls touching combustibles on opposite sides should not be welded on (or cut). Walls, ceilings, and floor near work should be protected by heat-resistant covers or shields.

Fire watcher must be standing by with suitable fire extinguishing equipment during and for some time after welding or cutting if:

- a. appreciable combustibles (including building construction) are within 35 feet
- b. appreciable combustibles are further than 35 feet but can be ignited by sparks
- c. openings (concealed or visible) in floors or walls within 35 feet may expose combustibles to sparks
- d. combustibles adjacent to walls, ceilings, roofs, or metal partitions can be ignited by radiant or conducted heat.

Hot work permit should be obtained before operation to ensure supervisor's approval that adequate precautions have been taken.

After work is done, check that area is free of sparks, glowing embers, and flames.

An empty container that held combustibles, or that can produce flammable or toxic vapors when heated, must never be welded on or cut, unless container has first been cleaned as described in AWS Standard A6.0, listed 7 in Standards Index.

This includes: a thorough steam or caustic cleaning (or a solvent or water washing, depending on the combustible's solubility) followed by purging and inerting with nitrogen or carbon dioxide, and using protective equip-

ment as recommended in A6.0. Waterfilling just below working level may substitute for inerting.

A container with unknown contents should be cleaned (see preceding paragraph). Do NOT depend on sense of smell or sight to determine if it is safe to weld or cut.

Hollow castings or containers must be vented before welding or cutting. They can explode.

Explosive atmospheres. Never weld or cut where the air may contain flammable dust, gas, or liquid vapors (such as gasoline).

D. Compressed Gas Equipment

Standard precautions. Comply with precautions in this manual, and those detailed in CGA Standard P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, listed 11 in Standards Index.

1. Pressure Regulators

Regulator relief valve is designed to protect only the regulator from overpressure; it is not intended to protect any downstream equipment. Provide such protection with one or more relief devices.

Never connect a regulator to a cylinder containing gas other than that for which the regulator was designed.

Remove faulty regulator from service immediately for repair (first close cylinder valve). The following symptoms indicate a faulty regulator:

Leaks-if gas leaks externally.

Excessive Creep-if delivery pressure continues to rise with downstream valve closed.

Faulty Gauge-if gauge pointer does not move off stop pin when pressurized, nor returns to stop pin after pressure release.

Repair. Do NOT attempt to repair. Send faulty regulators for repair to manufacturer's designated repair center, where special techniques and tools are used by trained personnel.

2. Cylinders

Cylinders must be handled carefully to prevent leaks and damage to their walls, valves, or safety devices:

Avoid electrical circuit contact with cylinders including third rails, electrical wires, or welding circuits. They can produce short circuit arcs that may lead to a serious accident. (See 1-3C.)

ICC or DOT marking must be on each cylinder. It is an assurance of safety when the cylinder is properly handled.

Identifying gas content. Use only cylinders with name of gas marked on them; do not rely on color to identify gas content. Notify supplier if unmarked. NEVER DEFACE or alter name, number, or other markings on a cylinder. It is illegal and hazardous.

Empties: Keep valves closed, replace caps securely; mark MT; keep them separate from FULLS and return promptly.

Prohibited use. Never use a cylinder or its contents for other than its intended use, NEVER as a support or roller.

Locate or secure cylinders so they cannot be knocked over.

Passageways and work areas. Keep cylinders clear of areas where they may be struck.

Transporting cylinders. With a crane, use a secure support such as a platform or cradle. Do NOT lift cylinders off the ground by their valves or caps, or by chains, slings, or magnets.

Do NOT expose cylinders to excessive heat, sparks, slag, and flame, etc. that may cause rupture. Do not allow contents to exceed 130°F. Cool with water spray where such exposure exists.

Protect cylinders particularly valves from bumps, falls, falling objects, and weather. Replace caps securely when moving cylinders.

Stuck valve. Do NOT use a hammer or wrench to open a cylinder valve that can not be opened by hand. Notify your supplier.

Mixing gases. Never try to mix any gases in a cylinder.

Never refill any cylinder.

Cylinder fittings should never be modified or exchanged.

3. Hose

Prohibited use. Never use hose other than that designed for the specified gas. A general hose identification rule is: red for fuel gas, green for oxygen, and black for inert gases.

Use ferrules or clamps designed for the hose (not ordinary wire or other substitute) as a binding to connect hoses to fittings.

No copper tubing splices. Use only standard brass fittings to splice hose.

Avoid long runs to prevent kinks and abuse. Suspend hose off ground to keep it from being run over, stepped on, or otherwise damaged.

Coil excess hose to prevent kinks and tangles.

Protect hose from damage by sharp edges, and by sparks, slag, and open flame.

Examine hose regularly for leaks, wear, and loose connections. Immerse pressured hose in water; bubbles indicate leaks.

Repair leaky or worn hose by cutting area out and splicing (1-2D3). Do NOT tape.

4. Proper Connections

Clean cylinder valve outlet of impurities that may clog orifices and damage seats before connecting regulator. Except for hydrogen, crack valve momentarily, pointing

outlet away from people and sources of ignition. Wipe with a clean lintless cloth.

Match regulator to cylinder. Before connecting, check that the regulator label and cylinder marking area, and that the regulator inlet and cylinder outlet match. NEVER CONNECT a regulator designed for a particular gas or gases to a cylinder containing any other gas.

Tighten connections. When assembling threaded connections, clean and smooth seats where necessary. Tighten. If connection leaks, disassemble, clean, and retighten using properly fitting wrench.

Adapters. Use a CGA adapter (available from your supplier) between cylinder and regulator, if one is required. Use two wrenches to tighten adapter marked RIGHT and LEFT HAND threads.

Regulator outlet (or hose) connections may be identified by right hand threads for oxygen and left hand threads (with grooved hex on nut or shank) for fuel gas.

5. Pressurizing Steps:

Drain regulator of residual gas through suitable vent before opening cylinder (or manifold valve) by turning adjusting screw in (clockwise). Draining prevents excessive compression heat at high pressure seat by allowing seat to open on pressurization. Leave adjusting screw engaged slightly on single-stage regulators.

Stand to side of regulator while opening cylinder valve.

Open cylinder valve slowly so that regulator pressure increases slowly. When gauge is pressurized (gauge reaches regulator maximum) leave cylinder valve in following position: For oxygen, and inert gases, open fully to seal stem against possible leak. For fuel gas, open to less than one turn to permit quick emergency shutoff.

Use pressure charts (available from your supplier) for safe and efficient, recommended pressure settings on regulators.

Check for leaks on first pressurization and regularly there-after. Brush with soap solution (capfull of Ivory Liquid* or equivalent per gallon of water). Bubbles indicate leak. Clean off soapy water after test; dried soap is combustible.

E. User Responsibilities

Remove leaky or defective equipment from service immediately for repair. See User Responsibility statement in equipment manual.

F. Leaving Equipment Unattended

Close gas supply at source and drain gas.

G. Rope Staging-Support

Rope staging-support should not be used for welding or cutting operation; rope may burn.

*Trademark of Proctor & Gamble.

1-3. ARC WELDING

Comply with precautions in 1-1, 1-2, and this section. Arc Welding, properly done, is a safe process, but a careless operator invites trouble. The equipment carries high currents at significant voltages. The arc is very bright and hot. Sparks fly, fumes rise, ultraviolet and infrared energy radiates, weldments are hot, and compressed gases may be used. The wise operator avoids unnecessary risks and protects himself and others from accidents. Precautions are described here and in standards referenced in index.

A. Burn Protection

Comply with precautions in 1-2.

The welding arc is intense and visibly bright. Its radiation can damage eyes, penetrate lightweight clothing, reflect from light-colored surfaces, and burn the skin and eyes. Skin burns resemble acute sunburn, those from gas-shielded arcs are more severe and painful. **DON'T GET BURNED; COMPLY WITH PRECAUTIONS.**

1. Protective Clothing

Wear long-sleeve clothing (particularly for gas-shielded arc) in addition to gloves, hat, and shoes (1-2A). As necessary, use additional protective clothing such as leather jacket or sleeves, flame-proof apron, and fire-resistant leggings. Avoid outer garments of untreated cotton.

Bare skin protection. Wear dark, substantial clothing. Button collar to protect chest and neck and button pockets to prevent entry of sparks.

2. Eye and Head Protection

Protect eyes from exposure to arc. **NEVER** look at an electric arc without protection.

Welding helmet or shield containing a filter plate shade no. 12 or denser must be used when welding. Place over face before striking arc.

Protect filter plate with a clear cover plate.

Cracked or broken helmet or shield should **NOT** be worn; radiation can pass through to cause burns.

Cracked, broken, or loose filter plates must be replaced **IMMEDIATELY**. Replace clear cover plate when broken, pitted, or spattered.

Flash goggles with side shields **MUST** be worn under the helmet to give some protection to the eyes should the helmet not be lowered over the face before an arc is struck. Looking at an arc momentarily with unprotected eyes (particularly a high intensity gas-shielded arc) can cause a retinal burn that may leave a permanent dark area in the field of vision.

3. Protection of Nearby Personnel

Enclosed welding area. For production welding, a separate room or enclosed bay is best. In open areas, surround the operation with low-reflective, non-combustible screens or panels. Allow for free air circulation, particularly at floor level.

Viewing the weld. Provide face shields for all persons who will be looking directly at the weld.

Others working in area. See that all persons are wearing flash goggles.

Before starting to weld, make sure that screen flaps or bay doors are closed.

B. Toxic Fume Prevention

Comply with precautions in 1-2B.

Generator engine exhaust must be vented to the outside air. Carbon monoxide can kill.

C. Fire and Explosion Prevention

Comply with precautions in 1-2C.

Equipment's rated capacity. Do not overload arc welding equipment. It may overheat cables and cause a fire.

Loose cable connections may overheat or flash and cause a fire.

Never strike an arc on a cylinder or other pressure vessel. It creates a brittle area that can cause a violent rupture or lead to such a rupture under rough handling.

D. Compressed Gas Equipment

Comply with precautions in 1-2D.

E. Shock Prevention

Exposed hot conductors or other bare metal in the welding circuit, or in ungrounded, electrically-HOT equipment can fatally shock a person whose body becomes a conductor. **DO NOT STAND, SIT, LIE, LEAN ON, OR TOUCH** a wet surface when welding, without suitable protection.

To protect against shock:

Wear dry insulating gloves and body protection. Keep body and clothing dry. Never work in damp area without adequate insulation against electrical shock. Stay on a dry duckboard, or rubber mat when dampness or sweat can not be avoided. Sweat, sea water, or moisture between body and an electrically HOT part or grounded metal reduces the electrical resistance, and could enable dangerous and possibly lethal currents to flow through the body.

A voltage will exist between the electrode and any conducting object in the work circuit. Examples of conducting objects include, but are not limited to, buildings, electrical tools, work benches, welding power source cases, workpieces, etc. **Never touch the electrode and any metal object unless the welding power source is off.**

1. Grounding the Equipment

Arc welding equipment must be grounded according to the National Electrical Code, and the work must be grounded according to ANSI Z49.1 "Safety In Welding And Cutting."

When installing, connect the frames of each unit such as welding power source, control, work table, and water circulator to the building ground. Conductors must be adequate to carry ground currents safely. Equipment made

electrically HOT by stray current may shock, possibly fatally. Do NOT GROUND to electrical conduit, or to a pipe carrying ANY gas or flammable liquid such as oil or fuel.

Three-phase connection. Check phase requirements of equipment before installing. If only 3-phase power is available, connect single-phase equipment to only two wires of the 3-phase line. Do NOT connect the equipment ground lead to the third (live) wire, or the equipment will become electrically HOT—a dangerous condition that can shock, possibly fatally.

Before welding, check ground for continuity. Be sure conductors are touching bare metal of equipment frames at connections.

If a line cord with a ground lead is provided with the equipment for connection to a switchbox, connect the ground lead to the grounded switchbox. If a three-prong plug is added for connection to a grounded mating receptacle, the ground lead must be connected to the ground prong only. If the line cord comes with a three-prong plug, connect to a grounded mating receptacle. Never remove the ground prong from a plug, or use a plug with a broken off ground prong.

2. Electrode Holders

Fully insulated electrode holders should be used. Do NOT use holders with protruding screws.

3. Connectors

Fully insulated lock-type connectors should be used to join welding cable lengths.

4. Cables

Frequently inspect cables for wear, cracks and damage. IMMEDIATELY REPLACE those with excessively worn or damaged insulation to avoid possibly-lethal shock from bared cable. Cables with damaged areas may be taped to give resistance equivalent to original cable.

Keep cable dry, free of oil and grease, and protected from hot metal and sparks.

5. Terminals And Other Exposed Parts

Terminals and other exposed parts of electrical units should have insulating covers secured before operation.

6. Electrode

a. Equipment with output on/off control (contactor)

Welding power sources for use with the gas metal arc welding (GMAW), gas tungsten arc welding (GTAW) and similar processes normally are equipped with devices that permit on-off control of the welding power output. When so equipped the electrode wire becomes electrically HOT when the power source switch is ON and the welding gun switch is closed. Never touch the electrode wire or any conducting object in contact with the electrode circuit unless the welding power source is off.

b. Equipment without output on/off control (no contactor)

Welding power sources used with shielded metal arc welding (SMAW) and similar processes may not be equipped with welding power output on-off control devices. With such equipment the electrode is electrically HOT when the power switch is turned ON. Never touch the electrode unless the welding power source is off.

7. Safety Devices

Safety devices such as interlocks and circuit breakers should not be disconnected or shunted out.

Before installation, inspection, or service, of equipment, shut OFF all power and remove line fuses (or lock or red-tag switches) to prevent accidental turning ON of power. Disconnect all cables from welding power source, and pull all 115 volts line-cord plugs.

Do not open power circuit or change polarity while welding. If, in an emergency, it must be disconnected, guard against shock burns, or flash from switch arcing.

Leaving equipment unattended. Always shut OFF and disconnect all power to equipment.

Power disconnect switch must be available near the welding power source.

F. Protection For Wearers of Electronic Life Support Devices (Pacemakers)

Magnetic fields from high currents can affect pacemaker operation. Persons wearing electronic life support equipment (pacemaker) should consult with their doctor before going near arc welding, gouging, or spot welding operations.

1-4. STANDARDS BOOKLET INDEX

For more information, refer to the following standards or their latest revisions and comply as applicable:

1. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126.
2. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
3. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126.
8. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING, CUTTING, AND ALLIED PROCESSES obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
9. NFPA Standard 70, NATIONAL ELECTRICAL CODE obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS obtainable

from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202.

12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.
13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103.
14. American Welding Society Standard AWSF4.1, RECOMMENDED SAFE PRACTICES FOR THE PREPARATION FOR WELDING AND CUTTING OF CONTAINERS AND PIPING THAT HAVE HELD HAZARDOUS SUBSTANCES, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126.
15. ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

SECTION 2 – SAFETY PRECAUTIONS AND SIGNAL WORDS

2-1. GENERAL INFORMATION AND SAFETY

A. General

Information presented in this manual and on various labels, tags, and plates on the unit pertains to equipment design, installation, operation, maintenance, and troubleshooting which should be read, understood, and followed for the safe and effective use of this equipment.

The nameplate of this unit uses international symbols for labeling the front panel controls. The symbols also appear at the appropriate section in the text.

B. Safety

The installation, operation, maintenance, and troubleshooting of arc welding equipment requires practices and procedures which ensure personal safety and the safety of others. Therefore, this equipment is to be installed, operated, and maintained only by qualified persons in accordance with this manual and all applicable codes such as, but not limited to, those listed at the end of Section 1 – Safety Rules For Operation Of Arc Welding Power Source.

2-2. SAFETY ALERT SYMBOL AND SIGNAL WORDS

The following safety alert symbol and signal words are used throughout this manual to call attention to and identify different levels of hazard and special instructions.



This safety alert symbol is used with the signal words **WARNING** and **CAUTION** to call attention to the safety statements.



WARNING statements identify procedures or practices which must be followed to avoid serious personal injury or loss of life.



CAUTION statements identify procedures or practices which must be followed to avoid minor personal injury or damage to this equipment.

IMPORTANT statements identify special instructions necessary for the most efficient operation of this equipment.

SECTION 3 – SPECIFICATIONS

Table 3-1. Specifications

Welding Power Source

Model	Rated Weld Output	Max. Open-Circuit Voltage	Input At Rated Load Single-Phase		KVA	KW	Control Circuit Voltage At Gun	Electrode Wire Feed Speed	Electrode Wire Diameter Capability	Weight	
			Amperes At							Net	Ship
			115V	230V							
MW 4110	90 Amperes @ 18 Volts DC 20% Duty Cycle	30	20	10	3	2.2	24 Volts DC	70-400 ipm (1.8-10.2 mpm)	.023 in. (0.6 mm)	88 lbs. (40 kg)	95 lbs. (43 kg)
MW 4230	120 Amperes @ 21 Volts DC 30% Duty Cycle	32	—	20	4.7	3.9		47-690 ipm (1.2-17.5 mpm)	.023 thru .035 in. (0.6 thru 0.9 mm)	94 lbs. (43 kg)	101 lbs. (46 kg)

MWG-160 Gun

Ampere Rating With CO ₂ 60% Duty Cycle	Wire Diameter	Cable Length	Cooling Method
160 Amperes	.023 in. (0.6 mm)	10 ft. (3.0 m)	Air

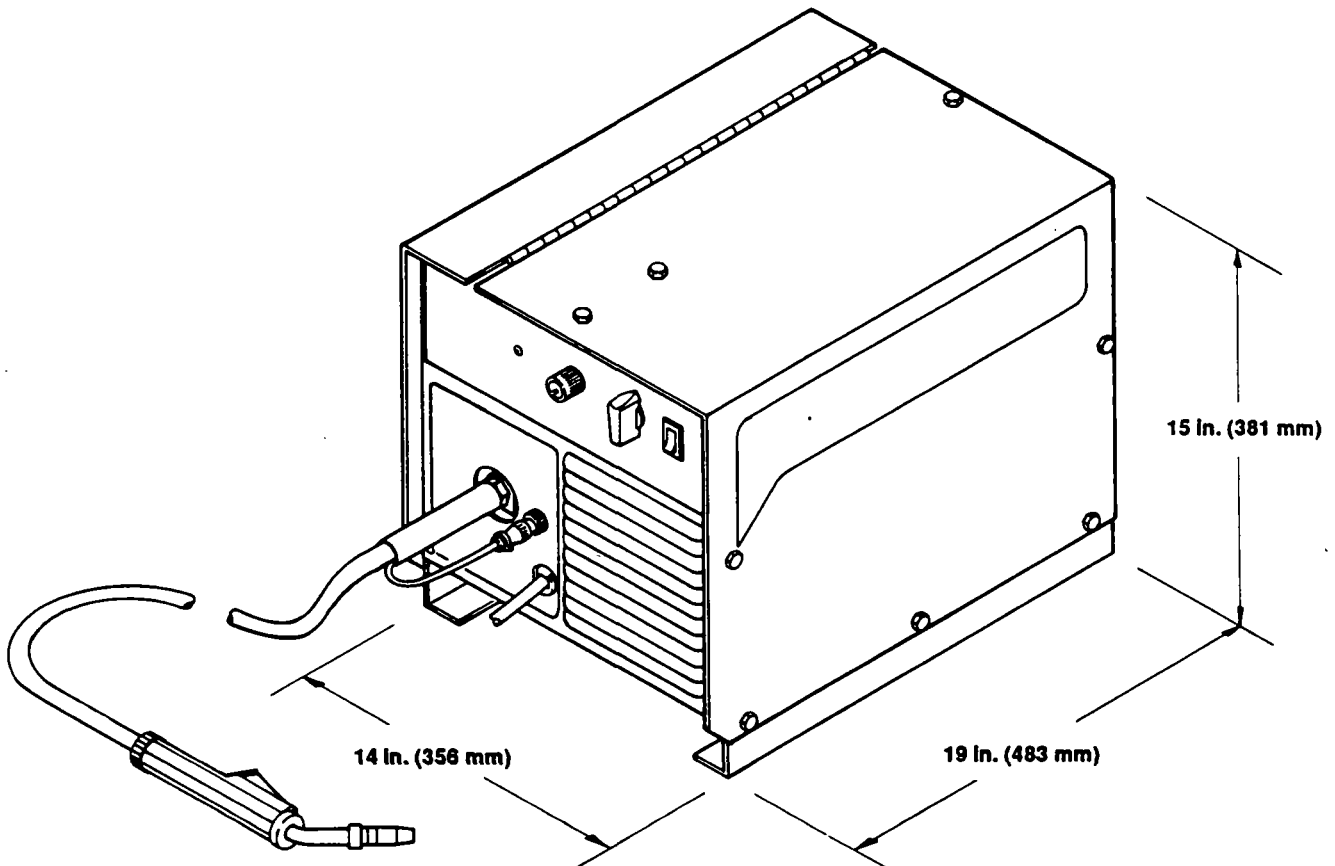


Figure 3-1. Overall Dimensions

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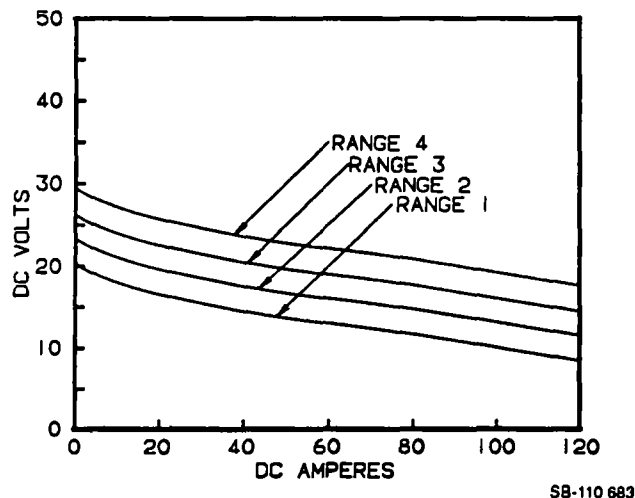
3-1. VOLT-AMPERE CURVES (Chart 3-1)

RATED OUTPUT

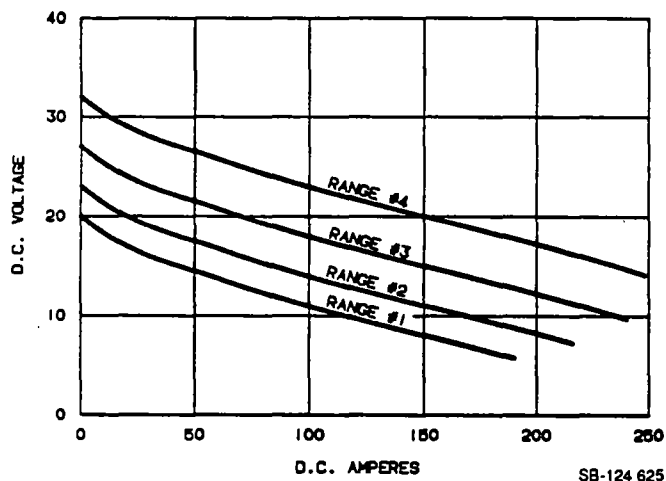
The volt-ampere curves show the minimum and maximum voltage and amperage output capabilities of the unit from the minimum and maximum settings of the FINE TUNING/WIRE SPEED control.

Chart 3-1. Volt-Ampere Curves

A. MW 4110 Models



B. MW 4230 Models



3-2. DUTY CYCLE

A. Welding Power Source (Chart 3-2)

The MW 4110 is rated at 20 percent duty cycle; therefore, the unit can be operated at rated load for two consecutive minutes out of ten, but it must idle for the remaining eight minutes to allow proper cooling.

The MW 4230 is rated at 30 percent duty cycle; therefore, the unit can be operated at rated load for three consecutive minutes, but it must idle for the remaining seven minutes to allow proper cooling.

Refer to the Duty Cycle Charts (Chart 3-2) to determine the output of the welding power source at various duty cycles.

IMPORTANT: *Decreasing welding amperes increases duty cycle.*

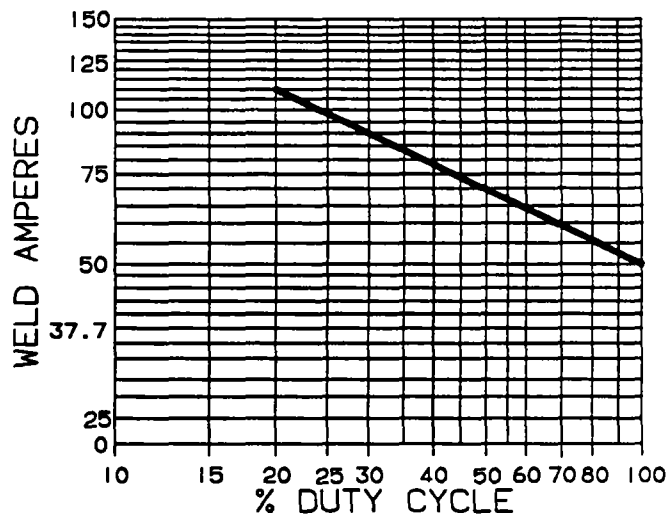


CAUTION: EXCEEDING DUTY CYCLE RATINGS will damage welding power source.

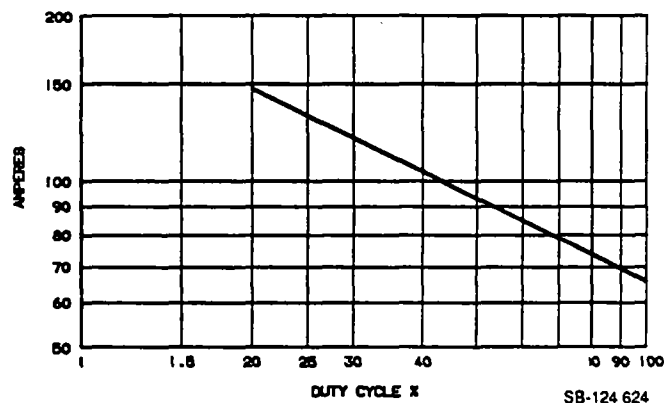
- Do not exceed indicated duty cycles.

Chart 3-2. Duty Cycle

A. MW 4110 Models



B. MW 4230 Models



B. Welding Gun

The duty cycle of a welding gun is the percentage of a ten minute period that a gun can be operated at a given load. This gun is rated at 60% duty cycle using CO₂ shielding gas. This means that the gun can be operated six minutes out of every ten with the CO₂ shielding gas. The remaining four minutes the gun should be idle to permit proper cooling.



CAUTION: EXCEEDING THE RATED AMPERAGE WITH CO₂ OR FAILING TO REDUCE THE WELDING AMPERAGE OR DUTY CYCLE WHEN USING A MIXED SHIELDING GAS can result in damage to the gun.

- Do not exceed rated amperage when using CO₂.
- Reduce duty cycle when using mixed shielding gases such as carbon dioxide and argon.

3-3. DESCRIPTION

The MW 4110 is a single-phase, constant voltage, dc arc welding power source and wire feed system designed for Gas Metal Arc Welding (GMAW) using a MWG-160 gun and .023 in. (0.6 mm) welding wire. Rated weld output is 90 amperes, 18 volts dc, at 20% duty cycle.

The MW 4230 is a single-phase, constant voltage, dc arc welding power source and wire feed system for Gas Metal Arc Welding (GMAW) using a MWG-160 gun and .023 through .035 in. (0.6 through 0.9 mm) welding wire. Rated weld output is 120 amperes, 21 volts dc, at 30% duty cycle.

All units are protected against short circuit overload (contact tube shorting to work) and overheating. If either condition occurs, the unit automatically shuts down.

3-4. SUPPLIED EQUIPMENT (Figure 3-2)

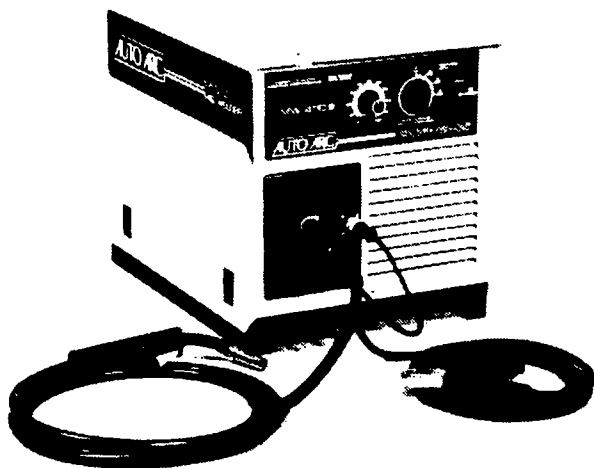


Figure 3-2. Supplied Equipment

Equipment supplied with the welding power source and requiring customer installation or assembly is listed below:

1. Welding gun with 1/2 in. (13 mm) seam nozzle and two contact tubes.
2. Work clamp.

The welding power source is factory equipped with a 10 ft. (3 m) input power cord and built-in gas valve.

3-5. ADDITIONAL REQUIRED EQUIPMENT (Figure 3-3)

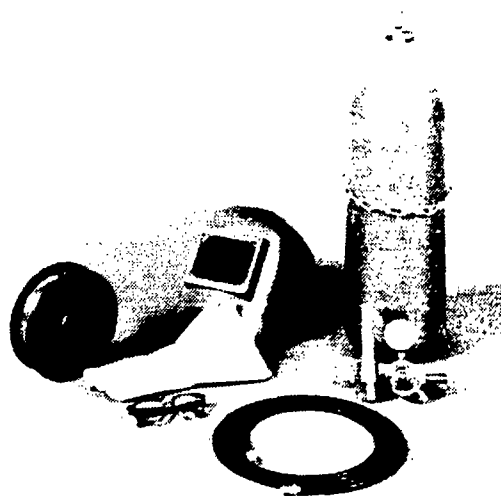


Figure 3-3. Additional Supplies Required

Contact your supplier or see the yellow pages of the local telephone book for the location of the nearest welding supply company to obtain the necessary equipment.

A. Gas Cylinder

Two types of gas are generally used with Gas Metal Arc Welding (GMAW) of thin gauge sheet steel. Carbon dioxide (CO₂) is the gas recommended for use with this welding power source/gun combination. A mixture of 75 percent argon and 25 percent carbon dioxide also gives favorable results. Obtain a cylinder of selected shielding gas. When welding power source is installed on running gear, a 20 lb. cylinder is the largest that can be used.

B. Regulator/Flowmeter

Regulator/flowmeters provide a constant shielding gas pressure and flow rate during the welding process. Because gases have different properties, each regulator/flowmeter is designed to be used with a specific gas or mixture of gases. Regulator/flowmeters cannot be changed from one gas to another unless the proper adapters are installed. Be sure to obtain the proper regulator/flowmeter for the type of gas used.

C. Gas Hose

Measure distance from gas cylinder to welding power source. Obtain good quality 5/8 in. (16 mm) O.D., S.A.E. gas hose, and install 5/8-18 right-hand thread fittings on both ends of hose.

D. Spool Of Wire

Selection of the correct welding wire is important in Gas Metal Arc Welding (GMAW). There are many types of wire from which to choose, but certain wires are best suited for welding thin gauge sheet steel. The American Welding Society (AWS) classification for GMAW wires is usually indicated on the label of the wire spool. Two AWS wire classes recommended are E70S-6 and E70S-3. The E70S-6 provides a more fluid (wetter) weld puddle and a flatter bead; however, E70S-6 is acceptable for use with this welding power source. Obtain a spool of selected wire.

E. Personal Safety Equipment

When using this welding power source, wear a welding helmet, fitted with the proper filter lens, to protect the eyes from the welding arc. Also important is wearing protective clothing, safety glasses, and gloves to prevent injury.

3-6. OPTIONAL EQUIPMENT

This unit can be equipped with two styles of running gear. If running gear was ordered with the unit, see running gear Owner's Manual for installation procedures.

3-7. CONSUMABLE PARTS

The following parts are subject to wear under normal usage:

1. Contact tubes
2. Contact tube adapters (170 Ampere Model Guns Only)
3. Nozzle
4. Drive Rolls

Spare parts should be available at all times.

SECTION 4 – INSTALLATION

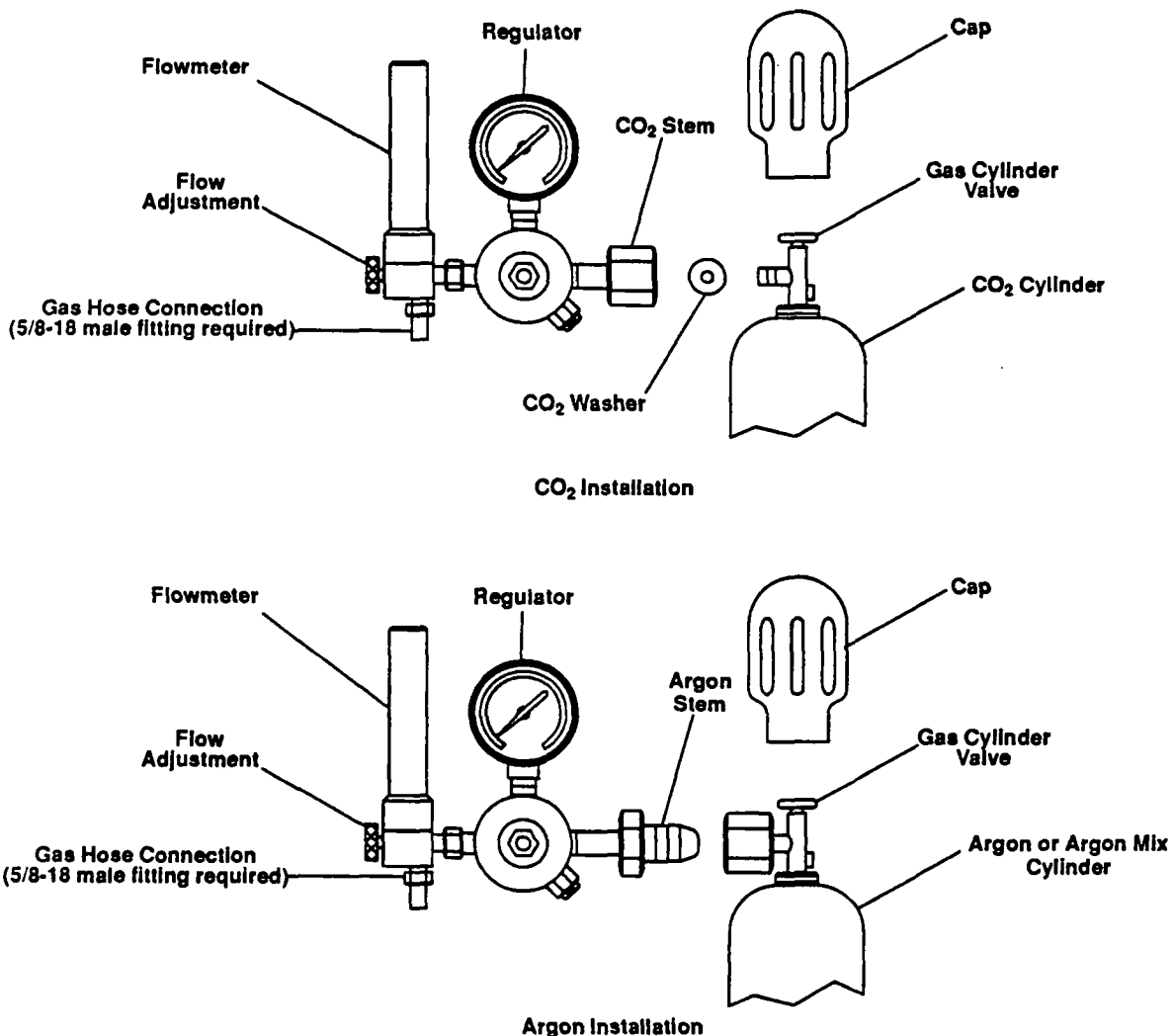


Figure 4-1. Typical Regulator/Flowmeter Installation

4-1. SITE SELECTION (Figure 3-1)

Select an installation site which provides the following:

1. Correct input power supply (see unit nameplate)
2. Shielding gas supply
3. Adequate ventilation and fresh air supply
4. No flammables
5. A clean and dry area
6. Proper temperature that avoids extremes of heat or cold
7. Proper airflow around unit
8. Adequate space for opening side access doors for installation, maintenance, and repair functions.

Base mounting holes provide the capability to install and secure the unit on a running gear or in a permanent location.



WARNING: FIRE OR EXPLOSION can result from placing unit on or over combustible surfaces; **RESTRICTED AIRFLOW** can cause overheating and possible damage to internal parts.

- Do not locate unit over combustible surfaces.
- Maintain at least 18 inches (457 mm) of unrestricted space on all sides of unit, and keep underside free of obstructions.
- Do not place any filtering device over the intake air passages that provide airflow for cooling this unit.

Warranty is void if any type of filtering device is used at intake air passages.

4-2. SHIELDING GAS INSTALLATION



WARNING: PRESSURIZED CYLINDERS can rupture causing serious personal injury and loss of life; **FALLING CYLINDERS** can cause serious injury and equipment damage.

- Keep cylinders away from welding or other electrical circuits.
- Never allow a welding electrode to touch any cylinder.
- Always fasten cylinder securely to running gear bracket, a wall, or other stationary support.

A. Gas Cylinder (Customer Supplied) (Figure 4-1)

Chain the cylinder to a wall or other stationary support to prevent the cylinder from falling over and breaking off the valve. If optional running gear is used, secure gas cylinder to running gear with supplied chain.

B. Regulator/Flowmeter (Customer Supplied) (Figure 4-1)

1. With the cylinder securely installed, remove the cylinder cap, stand to one side of cylinder valve, and open valve slightly. When gas flows from cylinder, close valve. This procedure blows out dust or dirt that may have accumulated around the valve seat.
2. The regulator/flowmeter must be properly equipped with a stem, nut connectors, and gasket for use with either CO₂ cylinders or inert gas type cylinders.

IMPORTANT: A gasket should be installed to prevent leaks. Do not use lubricants or sealing agents.

3. Install gas regulator/flowmeter onto gas cylinder valve; keep the face of the regulator/flowmeter gauge in vertical position, and tighten stem nut securely to gas cylinder valve.
4. A shielding gas output fitting is provided at the rear of the welding power source for making gas connections. Attach one end of the gas hose to this output fitting. Attach other end of the gas hose to the regulator/flowmeter.

4-3. WORK CLAMP INSTALLATION (Figure 4-2)

A 10 ft. (3 m) work cable with lug extends out of the front panel. Install work clamp onto the work cable as follows:



WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before installing work clamp.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

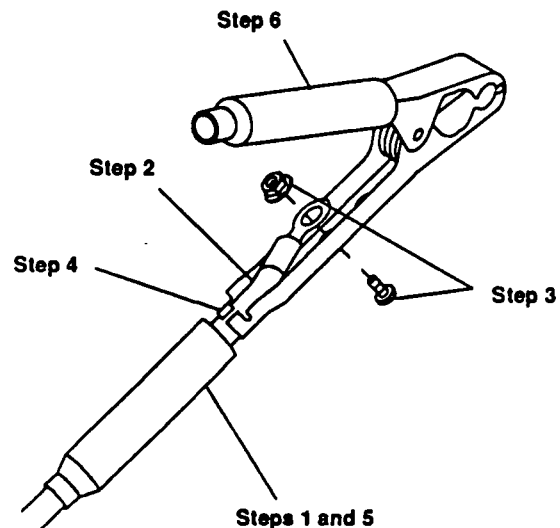


Figure 4-2. Work Clamp Installation

S-0250

1. Slide one piece of supplied insulating sleeve onto work cable.
2. Place work cable inside the handle of the work clamp with the flattest inner surface.
3. Align the smaller hole in the work clamp handle with the hole in the work cable terminal lug. Secure the terminal lug to the work clamp with the supplied nut and bolt.
4. Bend the tabs on the end of the work clamp around the work cable.
5. Slide insulating sleeve on work cable over work clamp handle.
6. Slide remaining insulating sleeve over other work clamp handle.

4-4. GUN POLARITY SELECTION PROCEDURE (Figure 4-3)



WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting or changing connections.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

The welding power source has jumper links that allow the user to select the polarity of the unit. The jumper links can be positioned for Reverse Polarity (DCEP) or Straight Polarity (DCEN) welding (see Figure 4-3).

The unit was shipped with the links positioned for Reverse Polarity (DCEP) welding using solid steel wire with the Gas Metal Arc Welding (GMAW) process. If using flux cored wire (without adding a shielding gas) and the Flux Cored Arc Welding (FCAW) process, position links for Straight Polarity (DCEN). Straight Polarity (DCEN) can also be used for welding with solid wire on very thin metal.

The jumper links are located behind the access door. The polarity changeover label (Figure 4-3) is located next to the polarity changeover board on the center baffle of the unit. If it is necessary to change jumper link positions, proceed as follows:

1. Open left side access door.
2. Loosen hardware securing jumper links to polarity changeover board.
3. Reposition jumper links as necessary, and tighten jumper link securing hardware.
4. Close and secure access door.

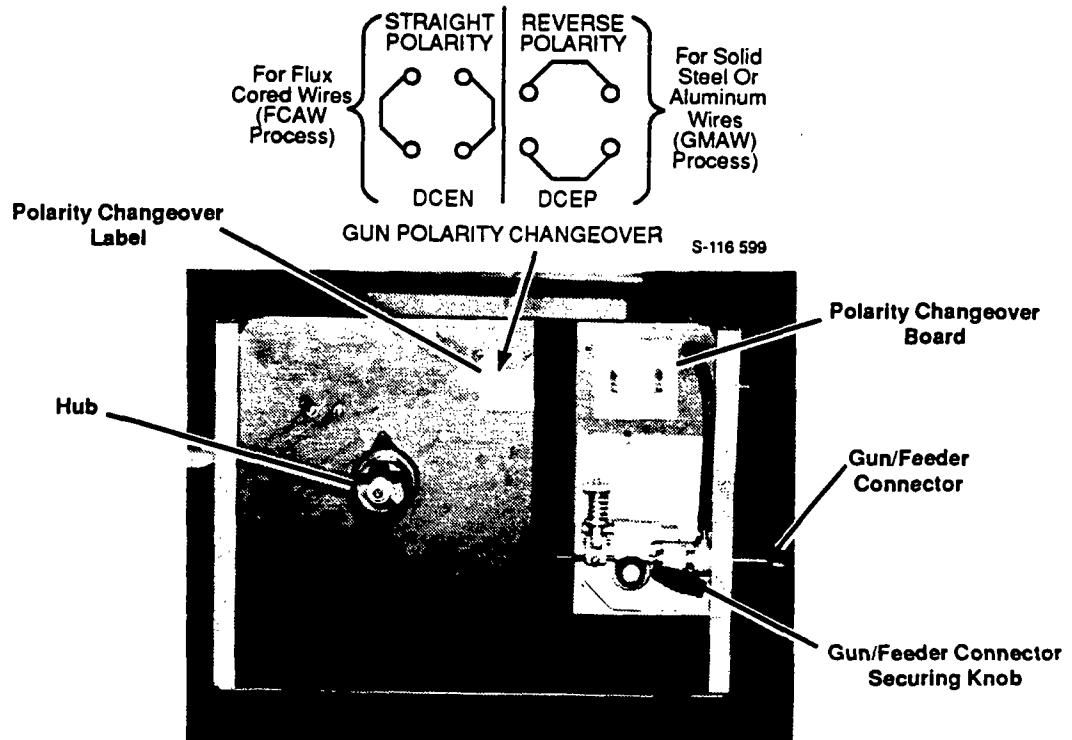


Figure 4-3. Gun Polarity Selection

4-5. WELDING GUN INSTALLATION (Figures 4-3 And 4-4)



WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting or installing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

A. Gun/Feeder Connector Installation (Figures 4-3 And 4-4)

IMPORTANT: The outlet guide is provided as part of the gun assembly.

1. Open access door.
2. Loosen the gun/feeder connector securing knob.

IMPORTANT: Wire guides should be installed so that the tip of the guide is as close to the drive rolls as possible without touching.

3. Insert gun/feeder connector through access hole in front panel and into drive assembly until gun/feeder connector is flush against drive assembly.
4. Tighten the gun/feeder connector securing knob.
5. Close and secure access door.

B. Gun Switch Connection (Figure 5-1)

The WELDING GUN receptacle is provided for making switch control connections. Align the keys on the gun switch connector with the keyways in the WELDING

GUN receptacle, insert the connector, and rotate collar fully clockwise.

4-6. WELDING WIRE SPOOL INSTALLATION (Figure 4-4)

1. Open left side door.
2. Remove retaining pin from hub.
3. Slide spool of wire onto hub so that wire feeds off bottom of spool. Do not loosen wire from spool.
4. Rotate spool until hole in spool aligns with pin in hub. Slide spool onto hub until it seats against back flange of hub.
5. Reinstall retaining pin onto hub in a position which prevents wire spool from moving in or out.
6. Close and secure access door.

4-7. ELECTRICAL INPUT CONNECTIONS



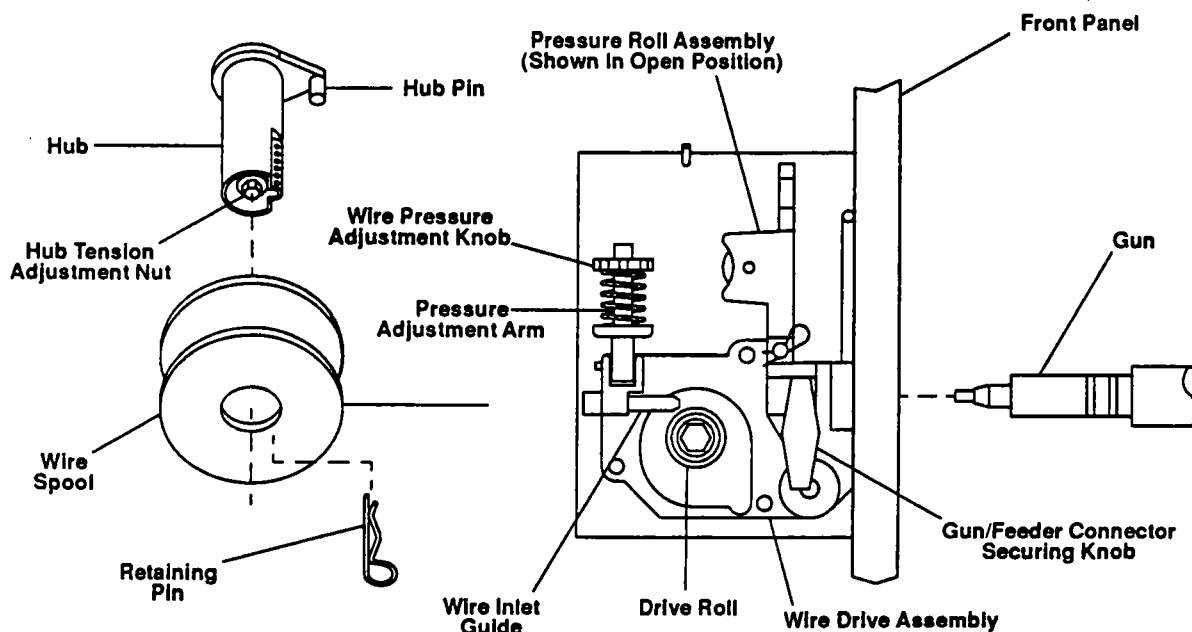
WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting or installing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

A. Electrical Input Requirements

The National Electrical Code (NEC) (Article 630B., 1987 Edition) provides standards for amperage handling capability of supply conductors based on the duty cycle of the welding power source.



SA-109 356-E

Figure 4-4. Welding Gun And Wire Spool Installation

The MW 4110 models have a 20% duty cycle (2 minutes of every 10 minutes can be used for welding); therefore, the supplied cord and attached plug comply with NEC standards for 20% duty cycle. Be sure that the building supply and receptacle comply with NEC standards and any additional state and local codes.

The MW 4230 (230 Volts only) models have a 30% duty cycle (3 minutes of every 10 minutes can be used for welding); therefore, the supplied cord and ring terminals comply with NEC standards for 30% duty cycle.

IMPORTANT: The supply wiring for the welding power source must be capable of handling a 15 ampere load for the MW 4110 models, and a 20 ampere load for the MW 4230 models. The welding power source must be the only load connected to the supply circuit. Poor unit performance or frequently opening line fuses or circuit breakers can result from an inadequate or improper supply.

B. Input Conductor Connections For MW 4110 Models

MW 4110 models are equipped with a cord and three-prong polarized plug. Check nameplate for input voltage requirement, and connect the plug to a properly grounded and protected (fuses or circuit breakers) 115 VAC receptacle capable of handling 15 amperes.

C. Input Conductor Connections For MW 4230 Models (Table 4-1 And Figure 4-4)



WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Install a fusible line disconnect switch in the input circuit to the welding power source.
- Read and follow safety information at beginning of entire Section 4-7 before proceeding.

The line disconnect switch provides a safe and convenient means to completely remove all electrical power from the welding power source whenever it is necessary to inspect or service the unit.

Table 4-1 provides guidelines for selecting the proper size line fuses.

Table 4-1. Line Disconnect Or Supply Circuit Fuse Size

Model	Fuse Size In Amperes*
MW 4110	30
MW 4230	30

*Fuse size is based on not more than 200 percent of the rated input amperage of the welding power source (Article 630 of NEC). S-0092/4-89

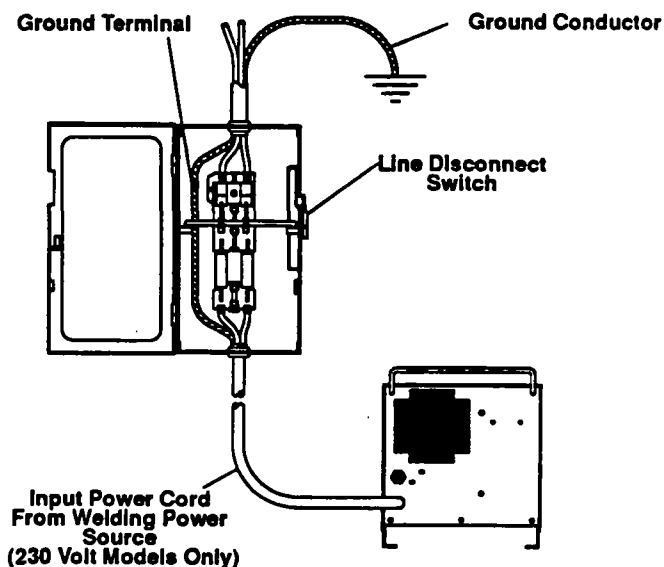


WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Do not connect an input conductor to the ground terminal in the line disconnect device.
- Do not connect the ground conductor to an input line terminal.

Incorrect input connections can result in an electrically energized welding power source chassis. The ground terminal is connected to the welding power source chassis and is for grounding purposes only.

Models requiring 230 volts input have prewired power cables with three conductors and ring terminals. Check the nameplate for input voltage requirement, and connect the conductors to a properly grounded and protected line disconnect device capable of handling 230 VAC at 20 amperes (see Figure 4-5). The black and white conductors must be connected to the line terminals, and the green conductor must be connected to a proper ground. Use a grounding method that is acceptable to the local electrical inspection authority.



SB-124 654-B

Figure 4-5. Power Cable Connections (230 Volt Models Only)

4-8. WELDING WIRE INSTALLATION

A. Threading Welding Wire (Figure 4-4)



WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause serious injury.

- Do not touch live electrical parts.
- Keep away from moving parts.
- Do not energize welding power source until instructed to do so.

The welding wire and all metal parts in contact with it are energized while welding.

WELDING WIRE can cause puncture wounds; HOT SURFACES can cause severe burns.

- *Do not press gun trigger until instructed to do so.*
- *Do not point gun toward any part of the body, any conductive surface, or other personnel when threading welding wire.*
- *Allow gun to cool before touching.*

1. Open and secure left side access door.
2. Install welding wire spool according to Section 4-6.
3. Loosen pressure adjustment knob, pivot pressure adjustment arm free of cover, and pivot pressure roll assembly away until it is in an open position (see Figure 4-4).



CAUTION: LOOSE WELDING WIRE can cause injury.

- *Keep firm hold on wire during installation, removal, and threading operations.*

Spooled wire has a tendency to unravel rapidly when loosened from the spool.

4. Unreel and straighten approximately 6 in. (152 mm) of wire from wire spool.
5. Cut off any wire that is bent, and remove any burrs or sharp edges.
6. Route welding wire into wire inlet guide, along drive roll groove, and into wire outlet guide in gun feeder/connector.
7. Pivot pressure roll assembly downward onto drive roll, making sure that wire is riding in drive roll groove.
8. Pivot pressure adjustment arm up until the washer on the adjustment arm is seated on top of the cover.
9. Rotate the pressure adjustment knob in a clockwise direction until the drive roll and pressure bearing are tight against the welding wire. Adjust

drive roll pressure just tightly enough to prevent the wire from slipping on or against drive roll during operation.



CAUTION: EXCESSIVE DRIVE ROLL TENSION can damage equipment and cause poor wire feeding.

- *Do not overtighten drive roll pressure adjustment knob.*

10. Lay gun cable assembly out as straight and flat as possible.



WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*

The welding wire is electrically energized whenever the gun trigger is depressed.

WELDING WIRE can cause puncture wounds.

- *Do not point gun toward any part of the body, other personnel, or any conductive surface when threading welding wire.*

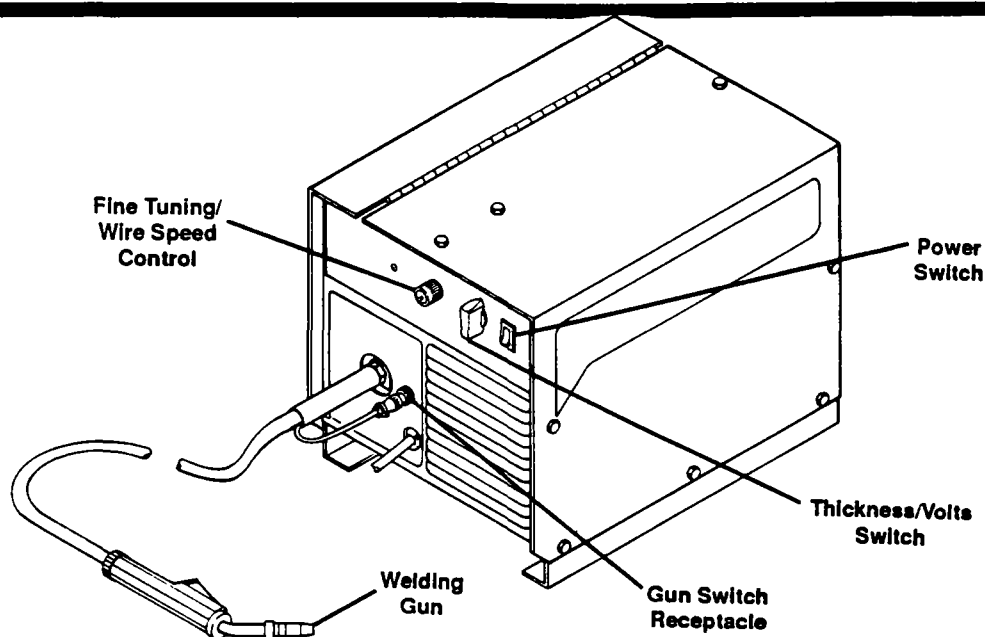
11. Energize welding power source.
12. Depress and hold the gun trigger until the wire feeds approximately 1/4 in. (6 mm) out the gun nozzle. If wire feeds more than 1/4 in. out nozzle, cut wire off to 1/4 in.
13. Deenergize welding power source.
14. Adjust hub tension according to Section 4-8B, if necessary.
15. Close and secure left side access door.

IMPORTANT: *For a smoother weld start, be sure welding wire extends 1/4 in. (6 mm) out end of contact tube and has a sharp end.*

B. Hub Tension Adjustment

Check hub tension by slowly pulling the wire toward the drive roll. The wire should unwind freely, but hub tension should be sufficient to keep the wire taut and prevent backlash when wire feeding ceases. If adjustment is required, loosen or tighten the hex nut on the end of the spindle support shaft accordingly.

SECTION 5 – OPERATOR CONTROLS



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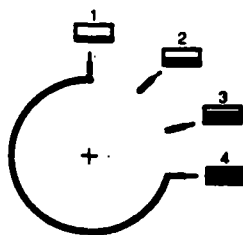
Figure 5-1. Operator Controls

5-1. POWER SWITCH (Figure 5-1)



Placing the POWER switch in the ON position energizes the welding power source. Placing the POWER switch in the OFF position shuts down the welding power source.

5-2. THICKNESS/VOLTS SWITCH (Figure 5-1)



**DO NOT OPERATE
SWITCH UNDER LOAD**

The THICKNESS/VOLTS switch provides a selection of four welding voltages:

	MW 4110 Model	MW 4230 Model
1 – Very Thin	20 Volts DC	20 Volts DC
2 – Thin	23 Volts DC	23 Volts DC
3 – Thicker	25 Volts DC	27 Volts DC
4 – Thickest	29 Volts DC	32 Volts DC



CAUTION: ARCING can damage contact surfaces.

- Do not change position of THICKNESS/VOLTS switch while welding or under load.

Arcing causes the contacts to become pitted and eventually inoperative.

5-3. FINE TUNING/WIRE SPEED CONTROL (Figure 5-1)

WIRE SPEED FINE TUNING



The FINE TUNING/WIRE SPEED control provides selection of the speed at which welding wire feeds into the weld. Rotating the FINE TUNING/WIRE SPEED control clockwise increases wire feed speed.

The scale around the FINE TUNING/WIRE SPEED control is calibrated in percent and does not indicate the actual wire feed speed.

IMPORTANT: The FINE TUNING/WIRE SPEED control may be adjusted while welding.

5-4. WELDING GUN RECEPTACLE (Figure 5-1)

Connect gun switch to this receptacle according to Section 4-5. When the gun switch is closed, the contactor in the welding power source energizes, shielding gas flows, and wire feeds.

SECTION 6 – SEQUENCE OF OPERATION



WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause serious injury; IMPROPER AIRFLOW AND EXPOSURE TO ENVIRONMENT can damage internal parts.

- *Do not touch live electrical parts.*
- *Keep away from moving parts.*
- *Keep all covers and panels in place while operating.*

Warranty is void if the welding power source is operated with any portion of the outer enclosure removed.

ARC RAYS, SPARKS, AND HOT SURFACES can burn eyes and skin; NOISE can damage hearing.

- *Wear correct eye, ear, and body protection.*

FUMES AND GASES can seriously harm your health.

- *Keep your head out of the fumes.*
- *Ventilate to keep from breathing fumes and gases.*
- *If ventilation is inadequate, use approved breathing device.*

WELDING WIRE can cause puncture wounds.

- *Do not point gun toward any part of the body, any conductive surface, or other personnel.*

HOT METAL, SPATTER, AND SLAG can cause fire and burns.

- *Watch for fire.*
- *Keep a fire extinguisher nearby, and know how to use it.*
- *Do not use near flammable material.*
- *Allow work and equipment to cool before handling.*

MAGNETIC FIELDS FROM HIGH CURRENTS can affect pacemaker operation.

- *Wearers should consult their doctor before going near arc welding, gouging, or spot welding operations.*

See Section 1 - Safety Rules For Operation Of Arc Welding Power Source for basic welding safety information.

6-1. GAS METAL ARC WELDING (GMAW)

1. Install and connect unit according to Section 4.
2. Prepare weld joint (see Sections 9 and 10).

3. Wear dry insulating gloves and clothing.
4. Be sure polarity changeover links are in desired position (see Section 4-4).
5. Select welding wire and shielding gas (see Table 6-1). Thread welding wire according to Section 4-8. Install shielding gas according to Section 4-2.
6. Connect work clamp to clean, bare metal at work-piece.
7. Set weld parameters using the THICKNESS/ VOLTS switch and FINE TUNING/WIRE SPEED control appropriate for the base metal thickness and type of shielding gas (see Table 6-1).
8. Close regulator/flowmeter flow adjustment knob, and slowly open the gas cylinder valve.
9. Purge shielding gas line as follows:



WARNING: ELECTRIC SHOCK can kill; ARC RAYS can burn eyes.

- *Do not touch live electrical parts.*
- *Keep the welding wire isolated from the work clamp or any conductive surface when not welding.*

The welding wire is electrically energized whenever the gun trigger is depressed.

- a. Release drive roll pressure.
- b. Place Line Disconnect switch in the ON position.
- c. Place POWER switch on the welding power source in the ON position.
- d. Depress gun trigger for approximately 15 seconds to allow for adjustment of regulator/flowmeter and to purge gas hose of air.

IMPORTANT: Gas pressure of 6 pounds or flow rate of 15 cfh are typical. Welding out of position at high wire feed speeds, or welding in a drafty environment will require more shielding gas.

- e. Place POWER switch on welding power source in OFF position, and retighten drive roll pressure according to Section 4-8.
10. Wear welding helmet with proper filter lens according to ANSI Z49.1.
 11. Place POWER switch on welding power source in ON position, and begin welding.
 12. Adjust hub tension and drive roll pressure as necessary (see Section 4-8).
 13. Adjust FINE TUNING/WIRE SPEED control as necessary.

6-2. SHUTTING DOWN

1. Stop welding.
2. Place POWER switch in OFF position.

3. Close gas cylinder valve.



WARNING: HIGH CONCENTRATION OF SHIELDING GAS can harm health or kill.

- Shut off gas supply when not in use.

Table 6-1. Suggested Settings For Welding

MW 4110 Models – GMAW

Shielding Gas And Flow Rate	Operator Control Settings	Material Thickness						
		12 ga.	14 ga.	16 ga.	18 ga.	20 ga.	22 ga.	24 ga.
CO ₂ 20 cfh+	Range	4	3	2	2	1	1	1
	Feed Speed*	70%	55%	48%	43%	25%	10%	6%
75% Argon 25% CO ₂ 20 cfh+	Range	3	3	2	1	1	–	–
	Feed Speed*	80%	60%	70%	60%	50%	–	–

*Adjust FINE TUNING/WIRE SPEED control as required.

+cfh = cubic feet per hour

MW 4230 Models – GMAW And FCAW

Wire Type, Shielding Gas, And Flow Rate	Wire Diameter (inch)	Operator Control Settings	Material Thickness							
			1/4 in. (6.4 mm)	3/16 in. (4.8 mm)	1/8 in. (3.2 mm)	14 ga.	16 ga.	18 ga.	22 ga.	24 ga.
E70S-6 CO ₂ 20 cfh+	.023	Range	–	4	3	2	2	1	1	1
		Feed Speed*	–	100%	80%	70%	60%	55%	45%	35%
	.030	Range	4	4	3	2	2	1	1	–
		Feed Speed*	80%	75%	60%	60%	50%	40%	30%	–
	.035	Range	4	4	3	2	1	1	1	–
		Feed Speed*	65%	60%	50%	40%	30%	20%	15%	–
E70S-6 75% Argon 25% CO ₂ 20 cfh+	.023	Range	–	4	3	2	2	1	1	1
		Feed Speed*	–	100%	90%	80%	70%	60%	50%	40%
	.030	Range	4	3	3	2	2	1	1	–
		Feed Speed*	90%	80%	70%	60%	50%	45%	30%	–
	.035	Range	4	3	3	3	2	2	1	–
		Feed Speed*	75%	70%	60%	50%	40%	33%	25%	–
E71T-GS Flux Core	.030	Range	3	3	2	1	1	1	–	–
		Feed Speed*	40%	65%	45%	40%	30%	20%	–	–
	.035	Range	3	3	2	1	1	1	–	–
		Feed Speed*	60%	50%	40%	30%	20%	10%	–	–
ER 308 Stainless Steel Tri-Mix 20 cfh+	.023	Range	4	4	3	3	3	2	1	–
		Feed Speed*	100%	100%	90%	85%	75%	70%	60%	–
	.030	Range	4	4	3	3	2	2	–	–
		Feed Speed*	75%	75%	65%	60%	55%	50%	–	–
	.035	Range	4	4	3	–	–	–	–	–
		Feed Speed*	60%	60%	50%	–	–	–	–	–
Aluminum Argon 20 cfh+	.030	Range	4	3	3	2	1	1	–	–
		Feed Speed*	90%	85%	80%	90%	90%	85%	–	–
	.035	Range	4	4	3	2	2	1	–	–
		Feed Speed*	85%	85%	85%	90%	90%	80%	–	–

*Adjust FINE TUNING/WIRE SPEED control as required.

+cfh = cubic feet per hour

IMPORTANT: If in doubt, set THICKNESS/VOLTS switch for voltage desired and set FINE TUNING/WIRE SPEED to 50. The weld can be started and fine tuned during operation. If input voltage is low, a higher THICKNESS/VOLTS setting may be required to obtain desired weld.

SECTION 7 – MAINTENANCE & TROUBLESHOOTING

7-1 ROUTINE MAINTENANCE (Table 7-1)

IMPORTANT: Every six months inspect the labels on this unit for legibility. All precautionary labels must be maintained in a clearly readable state and replaced when necessary. See Parts List for part number of precautionary labels.



WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- Keep away from moving parts.

HOT SURFACES can cause severe burns.

- Allow cooling period before servicing.

Maintenance to be performed only by qualified persons.

Table 7-1. Maintenance Schedule

Frequency*	Maintenance
Every month.	Units in heavy service environments: Check labels, weld cables, clean internal parts.
Every 6 months.	Check all labels (see IMPORTANT block, Section 7-1). Clean internal parts (see Section 7-1B).

*Frequency of service is based on units operated 40 hours per week. Increase frequency of maintenance if usage exceeds 40 hours per week

A. Fan Motor

This unit is equipped with an exhaust fan and relies on forced draft for adequate cooling. The fan motor is manufactured with lifetime sealed bearings and requires no maintenance.

B. Internal Cleaning



WARNING: Read and follow safety information at beginning of entire Section 7-1 before proceeding.

Every six months blow out or vacuum dust and dirt from the inside of the welding power source. Remove the

outer enclosure, and use a clean, dry airstream or vacuum suction for the cleaning operation. If dusty or dirty conditions are present, clean the unit monthly.

C. Inspection And Upkeep



WARNING: Read and follow safety information at beginning of entire Section 7-1 before proceeding.

Every six months, inspect the gun, hoses, and cables. If dusty or dirty conditions are present, inspect the unit monthly. Inspection should consist of the following:

1. Open side access door.
2. Inspect gun for broken areas, cracks, and loose parts; tighten, repair, and replace as required.
3. Repair or replace, as required, all hose and cable; give particular attention to frayed and cracked insulation and areas where hose and cables enter equipment.
4. Remove grease and grime from components, moisture from electrical parts and cable.



CAUTION: FLYING DIRT AND METAL CHIPS can injure personnel and damage equipment.

- Point gun liner only in a safe direction away from personnel and equipment when cleaning with compressed air.

5. Blow out the gun wire guide liner with compressed air when changing wire. This will remove any metal chips and dirt that may have accumulated.
6. Close and secure side access door.

D. Cleaning Of Drive Rolls



WARNING: Read and follow safety information at beginning of entire Section 7-1 before proceeding.

MOVING PARTS can cause serious injury.

- Keep away from moving parts.

HIGH ROTATIONAL SPEED can cause damage to drive rolls and injure personnel.

- Do not allow drive rolls to rotate at high speed if compressed air is used for cleaning the drive roll assembly.

It is necessary to remove the drive rolls for proper cleaning of the wire grooves (see Section 7-3 for removal and installation instructions). Use a wire brush to clean rolls.

IMPORTANT: Failure to properly maintain the drive rolls can result in a buildup of wire particles which decreases the efficiency of the wire feeding operation.

7-2. OVERLOAD PROTECTION

A. Short Circuit Shutdown

The unit is protected from damage due to contact tube short by optical coupler OC1 on motor control circuit board PC1. If the contact tube is shorted to the workpiece while welding, the unit completely shuts down. To resume operation, remove contact tube from workpiece, and continue welding.

B. Thermal Overload Protection

Rectifier SR2 is protected from overheating by a normally-closed thermostat TP1 in the relay CR1 and contactor CR2 control circuitry. Should overheating occur, TP1 would open causing CR1 and thereby the contactor to drop out (deenergize) thereby stopping all weld output. The thermostat automatically closes when the unit cools down. Allow a cooling period before continuing operation.

7-3. REPLACING DRIVE ROLL (Figure 7-1)

As a result of wear or a change in wire size, it may be necessary to replace the drive roll and wire inlet guide. Proceed as follows:



WARNING: ELECTRIC SHOCK can kill.

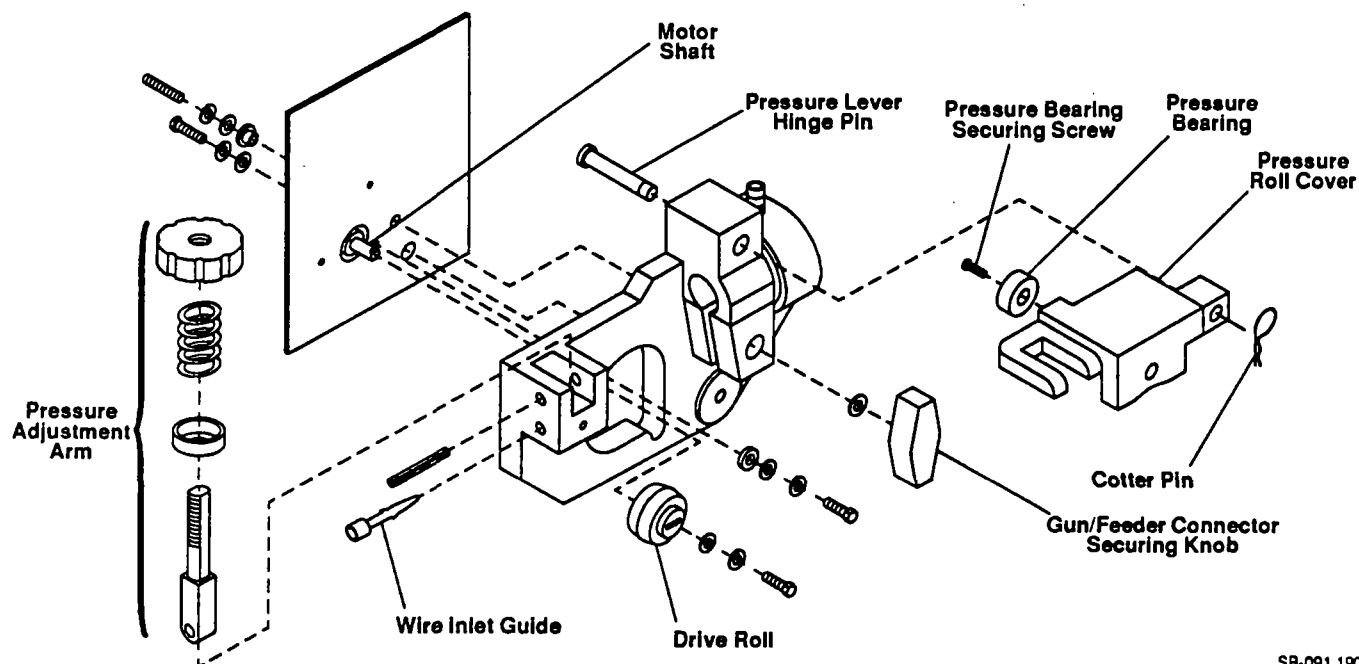
- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- Keep away from moving parts.

1. Open left side access door.
2. Loosen pressure adjustment knob, pivot pressure adjustment arm free of cover, and pivot pressure roll assembly away until it is in an open position.
3. Remove the drive roll securing bolt in the end of the motor shaft, and remove the drive roll from the shaft.
4. Slide new drive roll onto motor shaft until the drive roll bottoms against shoulder of motor shaft.
5. Reinstall securing bolt, and tighten.
6. Pivot pressure roll assembly downward onto drive roll, making sure that welding wire is riding in drive roll groove.
7. Pivot pressure adjustment arm up until the washer on the adjustment arm is seated on top of the cover.
8. Adjust drive roll pressure according to Section 4-8.
9. Close and secure side access door.



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Figure 7-1. Drive Roll And Pressure Bearing Replacement

7-4. REPLACING PRESSURE BEARING (Figure 7-1)



WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.*

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep away from moving parts.*

1. Open left side access door.
2. Loosen pressure adjustment knob, pivot pressure adjustment arm free of cover, and pivot pressure roll assembly away until it is in an open position.
3. Remove cotter pin from pressure lever hinge pin.
4. Remove pressure lever assembly from hinge pin.
5. Remove securing screw from pressure bearing, and remove pressure bearing from pressure lever assembly.
6. Install new pressure bearing, and reinstall securing screw.
7. Reinstall pressure lever assembly onto hinge pin.
8. Reinstall cotter pin onto end of hinge.
9. Pivot pressure roll assembly downward onto drive roll, making sure that welding wire is riding in drive roll groove.
10. Pivot pressure adjustment arm up until the washer on the adjustment arm is seated on top of the cover.
11. Adjust drive roll pressure according to Section 4-8.
12. Close and secure side access door.

7-5. REPLACING WIRE INLET GUIDE (Figure 7-1)

1. Open left side access door.
2. Loosen pressure adjustment knob, pivot pressure adjustment arm free of cover, and pivot pressure roll assembly away until it is in an open position.
3. Cut off welding wire at point where it enters wire inlet guide, and pull wire out nozzle-end of welding gun.

4. Loosen wire inlet guide securing screw.
5. Remove inlet guide from drive housing, and install new guide.

IMPORTANT: *Wire inlet guide should be installed as close to the drive rolls as possible without touching them.*

6. Tighten wire inlet guide securing screw.
7. Thread welding wire through wire drive assembly and gun according to Section 4-8.
8. Close and secure side access door.

7-6. REALIGNING DRIVE HOUSING (Figure 7-2)



WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.*

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

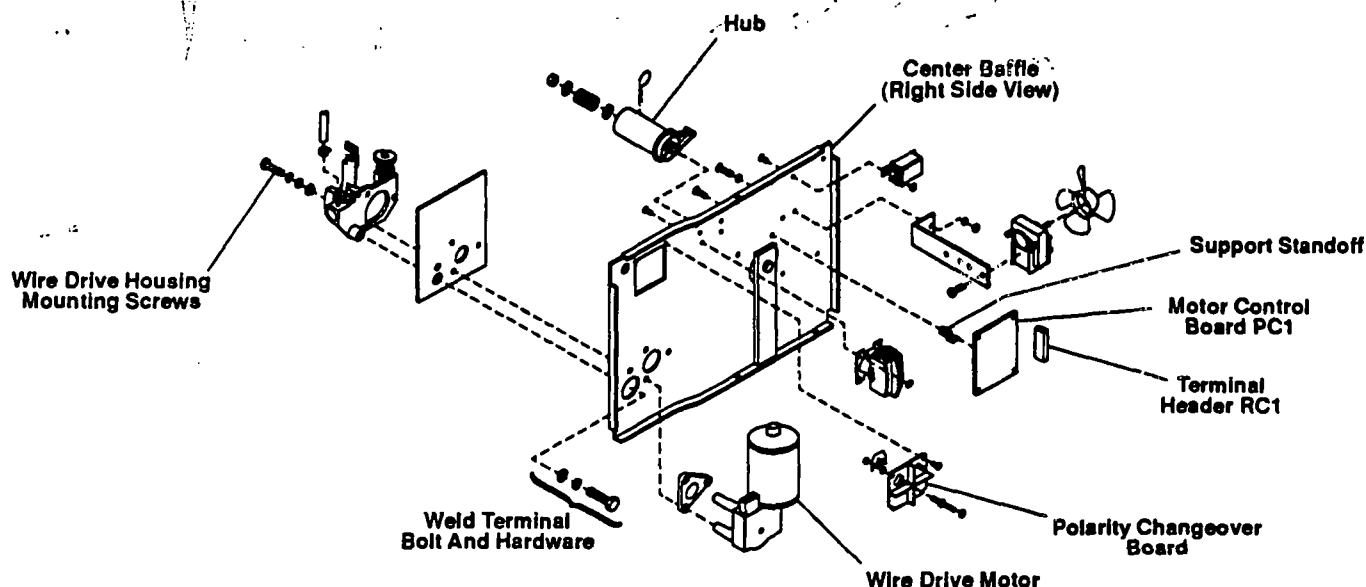
- *Keep away from moving parts.*

The wire drive housing is made with mounting holes of sufficient clearance to provide adjustment of the wire guides up or down in relation to the drive rolls. This adjustment has been factory set, but if readjustment becomes necessary proceed as follows:

1. Remove wrapper from unit.
2. Loosen mounting screws and the weld terminal stud hardware securing wire drive housing to center baffle.
3. Slide drive housing up or down until the wire can be fed straight through the wire inlet guide and into the wire outlet guide while wire is seated in drive roll groove.
4. Tighten mounting screws and weld terminal stud hardware.
5. Reinstall wrapper.

7-7. CIRCUIT BOARD REPLACEMENT (Figure 7-2)

If circuit board PC1 is at fault for a problem with the unit, replace the board using the following procedure. Do not attempt board repair. Contact the nearest Factory Authorized Service Station for correct replacement part.



Ref. SD-109 354-E

Figure 7-2. Motor Control Board PC1 Replacement



WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- Keep away from moving parts.



CAUTION: ELECTROSTATIC DISCHARGE (ESD) can damage circuit boards.

- Put on properly grounded wrist strap BEFORE handling circuit boards.
- Transport circuit boards in proper static-shielding carriers or packages.
- Perform work only at a static-safe work area.

INCORRECT INSTALLATION or misaligned plugs can damage circuit board.

- Be sure that plugs are properly installed and aligned.

EXCESSIVE PRESSURE can break circuit board.

- Use only minimal pressure and gentle movement when disconnecting or connecting board plugs and removing or installing board.

IMPORTANT: All directions, such as left or right, are with respect to the operator facing the unit front panel. Retain all hardware removed during this procedure for reinstallation unless specifically told otherwise.

1. Remove wrapper.
2. Remove terminal housing from terminal header RC1 on PC1.
3. Note board mounting position, release PC1 from support standoffs, and remove PC1 from center baffle in unit.
4. Install new PC1 onto center baffle, and reconnect terminal housing onto terminal header RC1 on new PC1. Be sure that all pins on RC1 mate with socket in terminal housing.
5. Reinstall wrapper onto unit.

7-8. WELDING GUN INSPECTION AND UPKEEP

Usage and shop conditions will determine frequency and type of maintenance required.



WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- Keep away from moving parts.

1. Inspect gun every three months or as use warrants for broken areas, cracks and loose parts; tighten, repair and replace as required.
2. Carefully remove any weld spatter or dirt which has accumulated around the nozzle opening.

- 3 Remove any accumulation around the switch.
- 4 Repair or replace as required all hose and cabling, give particular attention to frayed and cracked insulation and area where it enters equipment.
- 5 Remove grease and grime from components and moisture from electrical parts and cables.



CAUTION: FLYING DIRT AND METAL CHIPS can injure personnel and damage equipment.

- Point gun liner only in a safe direction away from personnel and equipment when cleaning with compressed air.

- 6 Blow out gun casing or liner with compressed air whenever the wire or liner is removed.

7-9. CONTACT TUBE REPLACEMENT (Figure 7-3)



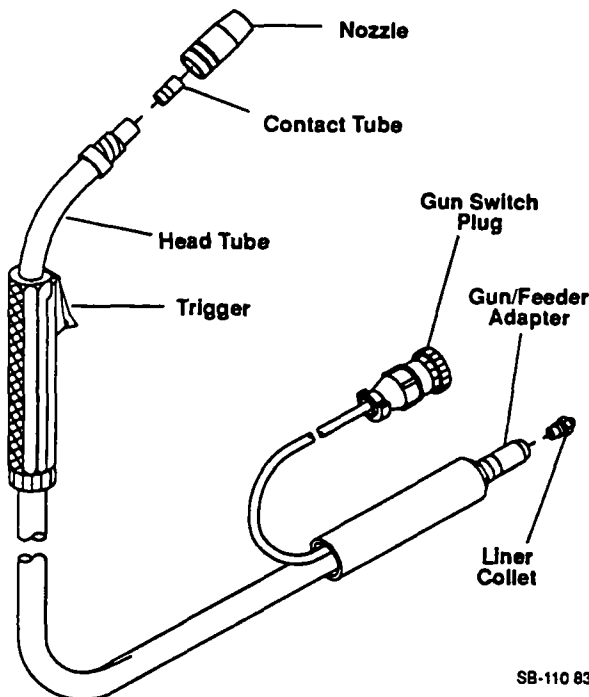
WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- Keep away from moving parts.



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Figure 7-3. MWG-160 Gun Parts Replacement

1. Remove nozzle.
2. Cut off any portion of the electrode wire which extends beyond end of tube.
3. Remove contact tube and replace with new contact tube.
4. Replace nozzle, and resume operation.

7-10. GUN LINER REPLACEMENT (Figure 7-3)



WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- Keep away from moving parts.

1. Remove nozzle.
2. Cut off any portion of the electrode wire which extends beyond end of contact tube.



CAUTION: LOOSE WELDING WIRE can cause injury.

- Keep firm hold on wire during installation, removal, and threading operations.

Spooled wire has a tendency to unravel rapidly when loosened from the spool.

3. Remove contact tube.
4. Retract wire onto wire spool.
5. Disconnect gun assembly from wire drive assembly.
6. Remove liner collet.
7. Lay cable assembly out flat and straight (no coils in the cable/conduit).
8. Pull out the liner from gun/feeder adapter end of gun assembly.



CAUTION: FLYING DIRT AND METAL CHIPS can injure personnel and damage equipment.

- Point gun liner only in a safe direction away from personnel and equipment when cleaning with compressed air.

9. Blow out gun casing or liner with compressed air whenever the wire or liner is removed.
10. Insert new liner into gun/feeder adapter end of gun. The liner should be flush with end of head tube.
11. Install collet and be sure liner is still flush with end of head tube.
12. Cut off liner 1/16 in. (1.6 mm) from collet.

13. Install contact tube.
14. Reinstall nozzle.
15. Reinstall gun to wire drive assembly.
16. Thread welding wire according to Section 4-8, and resume operation.

7-11: TROUBLESHOOTING (Table 7-2)



WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down wire feeder and welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.*

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep away from moving parts.*

HOT SURFACES can cause severe burns.

- *Allow cooling period before servicing.*

Troubleshooting to be performed only by qualified persons.

It is assumed that the unit was properly installed according to Section 4 of this manual, the operator is familiar with the function of controls, the welding power source was working properly, and that the trouble is not related to the welding process. The following table is designed to diagnose and provide remedies for some of the troubles that may develop in this welding power source.

Use this table in conjunction with the circuit diagram while performing troubleshooting procedures. If the trouble is not remedied after performing these procedures, the nearest Factory Authorized Service Station should be contacted. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly followed.



CAUTION: IMPROPER INPUT FUSES OR CIRCUIT BREAKERS can damage unit and/or input supply.

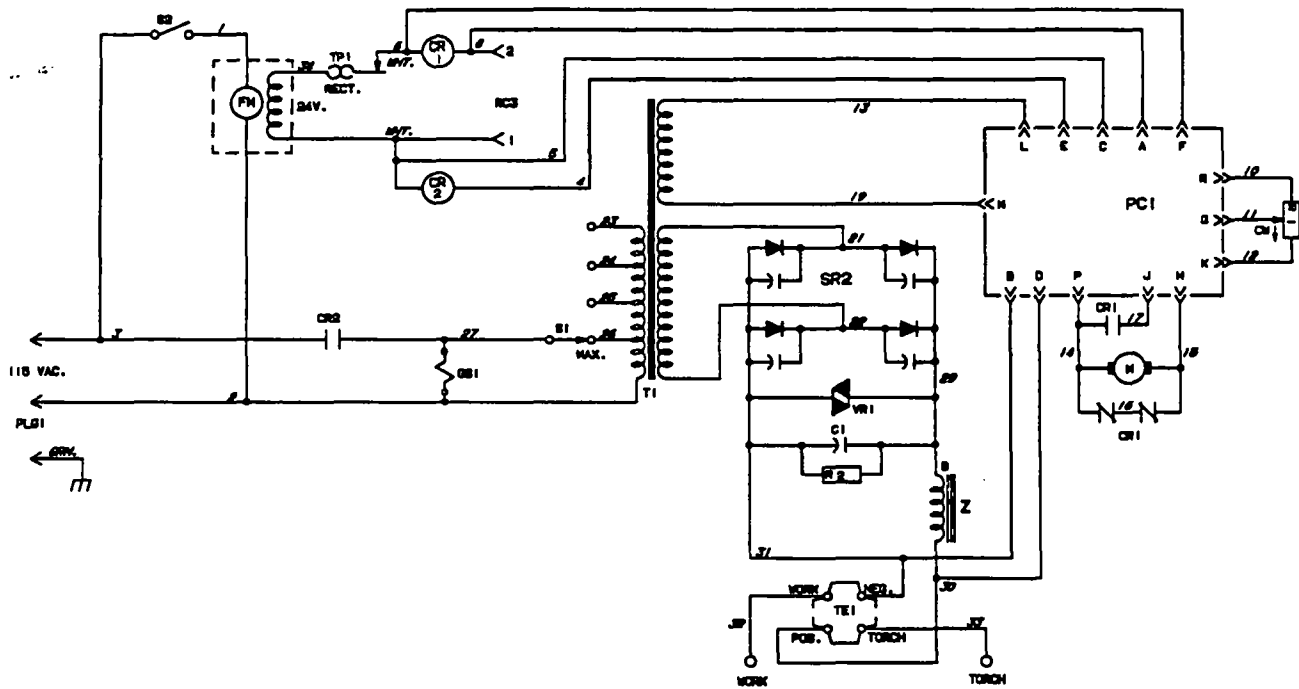
- *Be sure replacement input fuse amperage capacity matches that listed in Table 4-1 for the model used. Use fuse of same size and type.*
- *Use circuit breaker with amperage capacity that matches Table 4-1 for the model used.*

Correct overload problem before replacing fuse or resetting circuit breaker.

Table 7-2. Troubleshooting

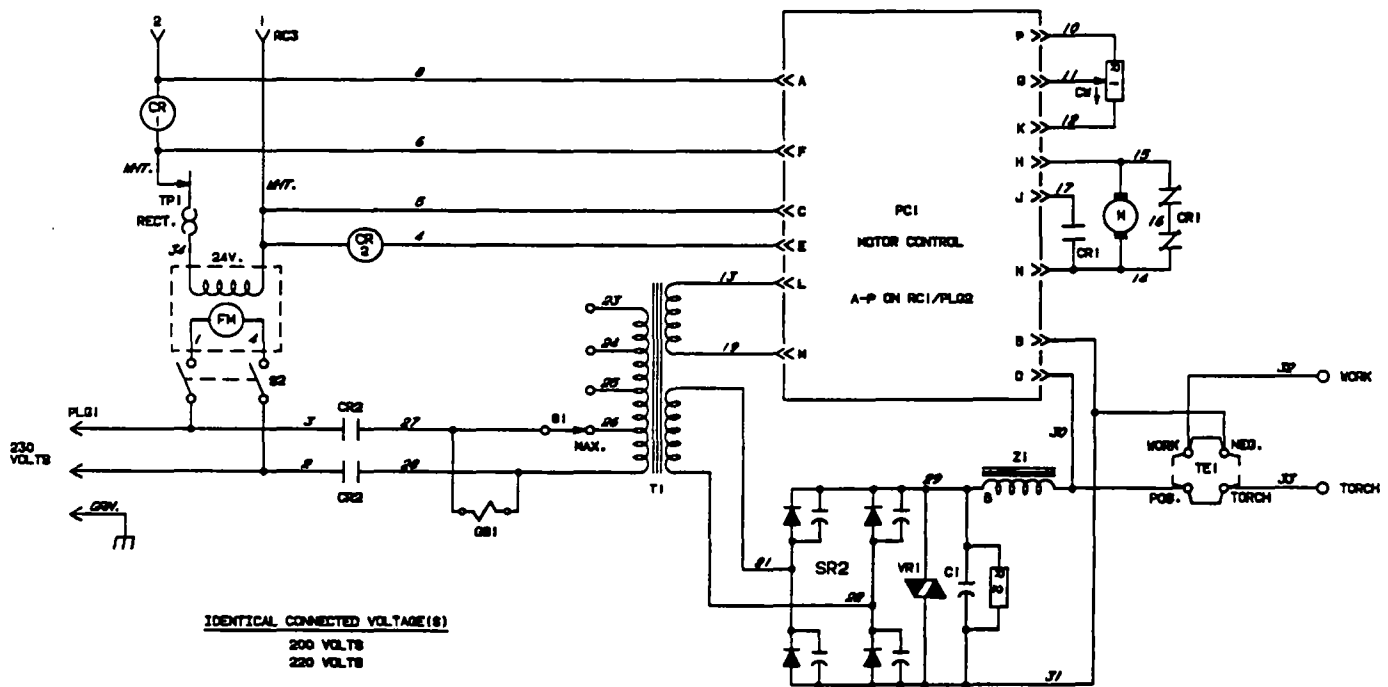
TROUBLE	PROBABLE CAUSE	REMEDY
No weld output; wire does not feed.	Power cord plug not secure in wall receptacle.	Secure plug in receptacle.
	Line fuse or circuit breaker open.	Replace line fuse or reset circuit breaker.
	Thermal overload.	Allow a cooling period (see Section 7-2).
	Gun switch connection not secure.	Secure gun switch connector in receptacle RC3.
	Gun switch, or gun switch leads open.	Replace gun switch (if applicable) or repair switch leads.
	Power switch S2.	Replace S2.
	Switch control relay CR1.	Replace CR1.
No weld output; wire feeds.	Work clamp connection loose or incomplete due to rust, paint, etc., on surface of workpiece.	Remake work connection ensuring good metal to metal contact.
	Contact tube.	Replace contact tube (see Section 7-9).
Low weld output.	Low input line power.	Connect unit to proper input voltage or check for low line voltage.
Electrode wire stops feeding while welding.	Sharp or excessive bend in gun cable or liner.	Straighten gun cable and/or replace liner (see Section 7-10).
	Incorrect drive roll pressure.	Adjust drive roll pressure (see Section 4-8).
	Incorrect hub tension.	Readjust hub tension (see Section 4-8).
	Contact tube opening restricted; burnback of wire into tube.	Replace contact tube (see Section 7-9).
	Friction in gun.	Check wire passage; clean, replace parts as required (see Sections 7-9 and 7-10).
	Gun casing liner dirty or plugged.	Clean or replace liner. (see Section 7-10).
	Broken or damaged casing or liner.	Replace damaged parts (see Section 7-10).
	Drive roll or pressure roll worn or slipping.	Replace drive roll or pressure bearing as required (see Sections 7-3 and 7-4).
	Gun trigger switch or wire leads broken.	Replace switch; check connections.
	Excessive loading of drive motor.	Clear restriction in drive assembly.
	Drive motor.	Contact nearest Factory Authorized Service Station.
	Motor Drive Board PC1.	Replace PC1 according to Section 7-7.

SECTION 8 – ELECTRICAL DIAGRAMS



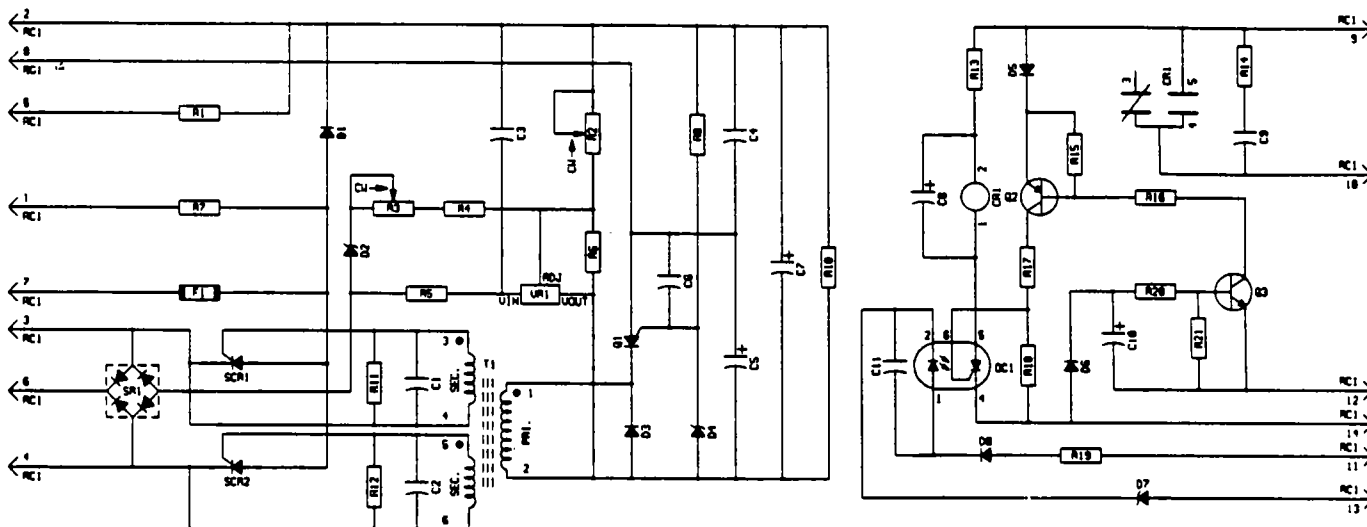
Circuit Diagram No. SB-119 059

Diagram 8-1. Circuit Diagram For MW 4110 Models



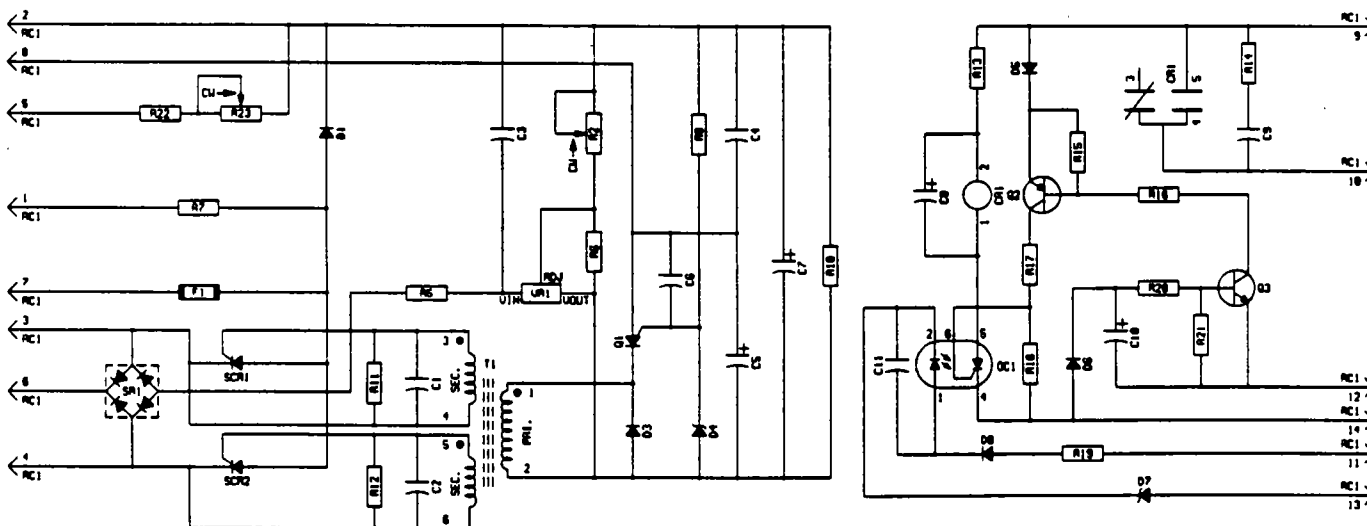
Circuit Diagram No. SB-119 063-C

Diagram 8-2. Circuit Diagram For MW 4230 Models



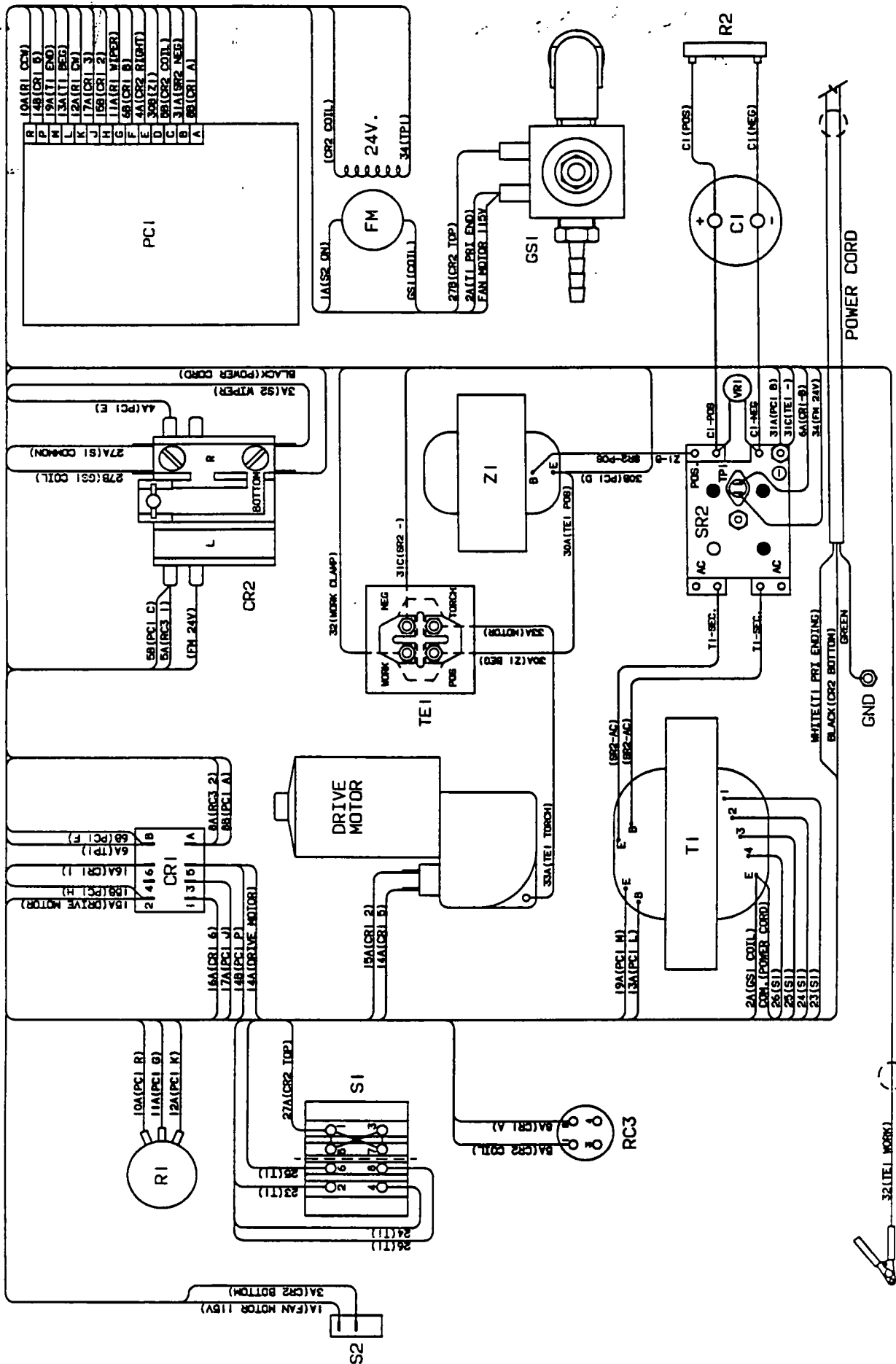
Circuit Diagram No. SC-137 798

Diagram 8-3. Circuit Diagram For MW 4110 Motor Control Board PC1



Circuit Diagram No. SC-137 801

Diagram 8-4. Circuit Diagram For MW 4230 Models Motor Control Board PC1



Wiring Diagram No. SC-119 132-B

Diagram 8-5. Wiring Diagram For MW 4110 Models



Diagram 8-6. Wiring Diagram For MW-4230 Models

SECTION 9 – WELDING TECHNIQUES & TROUBLESHOOTING



CAUTION: WELDING CURRENT can damage vehicle components and other electronic components.

- *Disconnect both battery cables before welding on a vehicle.*
- *Place work clamp as close to the weld as possible to avoid long electrical paths.*
- *Be sure gun to power source as well as cable connections to work clamp are clean and tight.*
- *To minimize risk, disconnect the computer(s) from the vehicle.*

9-1. GAS METAL ARC WELDING (GMAW) – CONTINUOUS SEAM

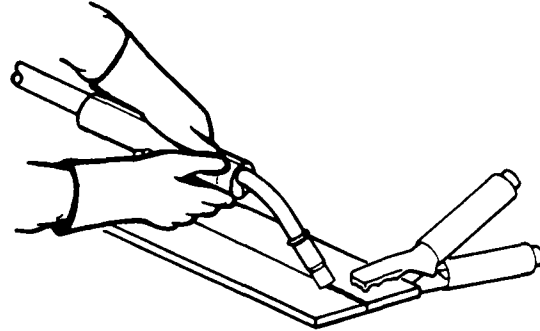


Figure 9-1. Continuous Seam

The ability to produce a good bead while using the Continuous Seam Gas Metal Arc process is dependent on several factors. One of the most important, after wire and shielding gas selection, is the way the gun is held. Cradle the gun in one hand and rest the side of the hand on the workpiece (avoid doing this on hot material); use other hand to hold gun and control the gun trigger. Position the gun either toward or away from the body at a 45 to 60 degree lead angle (see Figure 8-2). This will give a good view of the arc and make it easier to follow the seam while wearing a helmet. Maintain a 1/4 to 5/16 inch (6-8 mm) distance from the bottom of the gun nozzle to the workpiece during the arc starting and welding period. Do not pull the gun back from the seam when the arc starts, as this will create a long wire extension and result in a poor weld.

The welding wire is not energized until the trigger is pressed. Therefore the welding wire can be extended 1/4 inch (6 mm) beyond the gun nozzle and placed on the

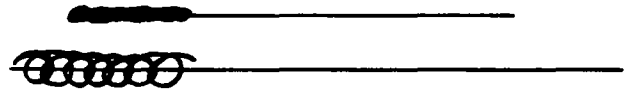
seam before lowering the helmet and pressing the gun trigger.



TA-057 469-118

Figure 9-2. Gun Position

The gun can be moved along the seam in a steady movement known as the drag technique (see Figure 8-3), or it can be oscillated a few degrees beyond each side of the seam. The travel speed will be regulated by the type of weld bead required, the thickness of the material, welding current selected and the technique used. However, the average speed is 15 to 20 inches per minute (0.4-0.5 mpm).



TA-057 469-18

Figure 9-3. Welding Techniques

Other welding techniques that affect the weld characteristics in the GMAW welding process include the backhand and forehand technique, and the vertical up and vertical down positions. In the backhand technique the gun is positioned so that the electrode wire is feeding in the opposite direction of arc travel. The filler metal is being fed into the weld metal previously deposited. In the forehand technique the gun is angled so that the electrode wire is fed in the same direction as the arc travel. The backhand technique generally yields a more stable arc and less spatter on the workpiece.



Direction of Arc Travel →

Backhand Technique



← Direction of Arc Travel

Forehand Technique

Figure 9-4. Longitudinal Gun Positions

The vertical up and/or vertical down techniques describe the direction of arc travel when the welding must be done in the vertical position. In both of these techniques gun positioning is extremely important because the arc must be kept on the leading edge of the puddle to ensure com-

plete weld penetration. The drag technique is generally employed when welding in the vertical position, but when bridging a gap, the arc can be oscillated from one side of the work to the other.



Vertical Up



Vertical Down

Figure 9-5. Welding In The Vertical Up And Vertical Down Position

9-2. TROUBLESHOOTING THE GAS METAL ARC WELDING (GMAW) PROCESS

A. Porosity



Figure 9-6. Porosity

Possible Causes	Corrective Actions
1. Inadequate shielding gas coverage.	Remove spatter from the gun nozzle.
	Check gas hoses for leaks.
	Eliminate drafts (from fans, open doors, etc.) blowing into the welding arc.
	Place nozzle 1/4 to 5/16 in. (6-8 mm) from workpiece.
	Increase gas flow to displace all air from the weld zone.
	Decrease excessive gas flow to avoid turbulence and the entrapment of air in the weld zone.
	Hold gun at end of weld until molten metal solidifies.
	Check for frozen CO ₂ regulator/flowmeter.
2. Wrong gas.	Use welding grade shielding gas.
3. Dirty welding wire.	Use clean and dry welding wire.
	Eliminate pick up of oil or lubricant on welding wire from feeder or conduit.
4. Workpiece dirty.	Remove all grease, oil, moisture, rust, paint, undercoating, and dirt from work surface before welding.
	Use a more highly deoxidizing welding wire.
5. Welding wire extends too far out of nozzle.	Welding wire should extend 1/4 in. (6 mm) out of nozzle.

B. Excessive Spatter

Possible Causes	Corrective Actions
1. Excessive spatter when using CO ₂ shielding gas.	Select lower voltage range or adjust FINE TUNING/ WIRE SPEED control.

C. Incomplete Fusion



Figure 9-7. Incomplete Fusion

Possible Causes	Corrective Actions
1. Workpiece dirty.	Clean weld surfaces of impurities (grease, oil, moisture, rust, paint, dirt, etc.) prior to welding.
2. Insufficient heat input.	Select higher voltage range or adjust FINE TUNING/ WIRE SPEED control.
3. Improper welding technique.	When using a weaving technique dwell momentarily on the side walls of the groove.
	Provide improved access at root of joints.
	Keep electrode directed at the leading edge of the puddle.
	Provide proper gun angle (see Section 7-1).

D. Lack of Penetration



Figure 9-8. Lack of Penetration

Possible Causes	Corrective Actions
1. Improper joint preparation.	Material too thick. Joint preparation and design must be adequate to provide access to the bottom of the groove while maintaining proper welding wire extension and arc characteristics.
2. Improper weld technique.	Maintain normal gun angle to achieve maximum penetration (see Section 7-1).
	Keep arc on leading edge of the puddle.
3. Insufficient heat input.	Select higher voltage range and wire speed.
	Reduce the travel speed.
	Be sure welding wire extends 1/4 in. (6 mm) out of nozzle.

E. Excessive Penetration (Burn-Through)



Figure 9-9. Excessive Penetration

Possible Causes	Corrective Actions
1. Excessive heat input.	Select lower voltage range and reduce wire speed.
	Increase travel speed.

F. Cracks In Weld Metal

Possible Causes	Corrective Actions
1. Improper joint preparation.	Material too thick. Joint preparation and design must be adequate to provide access to the bottom of the groove while maintaining proper welding wire extension and arc characteristics.
2. Heat input too high causing excessive shrinkage and distortion.	Select lower voltage range and reduce wire speed.
	Increase travel speed.

G. Waviness of Bead



Figure 9-10. Waviness of Bead

Possible Causes	Corrective Actions
1. Welding wire extends too far out of nozzle.	Welding wire should extend 1/4 in. (6 mm) out of nozzle.
2. Unsteady hand.	Support hand on solid surface.

H. Humping



Figure 9-11. Humping

Possible Causes	Corrective Actions
1. Excessive heat input.	Select lower voltage range or increase travel speed.
	Weld in small segments and allow to cool between welds.

SECTION 10 – AUTO BODY REPAIR APPLICATION



CAUTION: WELDING CURRENT can damage vehicle computers and other electronic components.

- *Disconnect both battery cables before welding on a vehicle.*
- *Place work clamp as close to the weld as possible to avoid long electrical paths.*
- *Be sure gun to power source as well as cable connections to work clamp are clean and tight.*
- *To minimize risk, disconnect the computer(s) from the vehicle.*

10-1. POINTERS FOR WELDING AUTO BODY SHEET METAL

Before using this equipment to weld on a finished piece of work, make a few practice welds on a sample piece of material the same as that of the finished workpiece. Whenever possible, weld in the flat position since this is the easiest position to learn. Be sure that the material to be welded is clean and free of paint and rust. The work cable clamp must be attached to the parts being welded. Clean surface to ensure proper grounding and to complete the current path.

Use a .023 in. (0.6 mm) E70S-6 wire and argon/carbon dioxide shielding gas.

Use direct current straight polarity (electrode negative) for reduced burn through. Check position of gun polarity changeover jumper links according to information found in a separate section previously covered in this manual. If necessary, reposition jumper links.

IMPORTANT: *For maximum penetration on thicker materials such as 18 gauge (1.22 mm) and thicker, reconnect for direct current reverse polarity (work lead to negative, electrode wire to positive).*

10-2. PROCEDURE FOR WELDING MILD STEELS

The following are some basic guidelines that can be used when using this welding power source to weld mild or high strength steels:

17. Use a power wire brush or sander to remove paint to bare metal in the area to be repaired. Two to three inches (51-76 mm) on either side of the weld area should be cleaned for applying body filler after welding is completed.
18. Remove damaged metal using hand cutters, shears, or a power hand grinder equipped with a cutting wheel.
19. Fit a new piece of sheet steel over the section which was removed. The new material should overlap the cut away section by one inch (25 mm).

20. Clamp the new metal in place, and prepare to spot weld.
21. Place the VOLTAGE ADJUSTMENT switch in the 3 position.
22. Install the spot nozzle on the gun.
23. With the shielding gas and power source turned on, place the spot nozzle and press firmly against the new material about 1/2 to 3/4 in. (12-18 mm), from the edge. Fit up must be tight to assure good, repeatable spot welds.
24. Begin spot welding from the center out on each side. Distortion may occur if welding begins at the corners.
25. Space spot welds 1 to 1/2 in. (25-38 mm) apart around repair. Spot welds should be about 3/16 in. (5 mm) in diameter.

IMPORTANT: *Do not make continuous welds around the repair as this will promote distortion and warpage.*

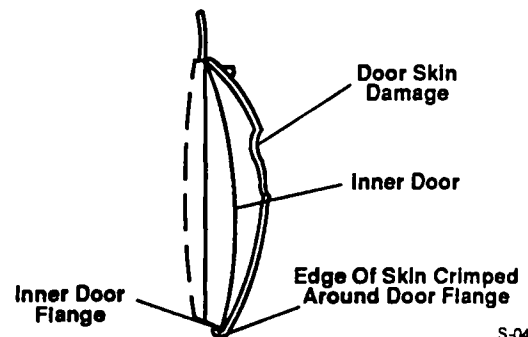
26. After welding, remove the clamp and grind spot flush to surface.
27. Smooth the joints with body filler and finish.

10-3. PROCEDURES FOR WELDING DOOR PANELS

IMPORTANT: *Every experienced autobody repairman will have his own method of performing the following procedures. However, this information is presented to show how, in most cases, this welding power source can make the job easier and less time consuming.*

If the door is severely damaged, but the damage is primarily in the outer panel, or "skin", the door can be easily repaired without necessarily installing a whole new door.

1. Remove exterior molding and hardware. It is not necessary to remove window regulator, remote control mechanisms, lock or runs.
2. Remove door assembly, and place on flat surface with edge of door extending over edges of surface to provide room to work.



S-0418

Figure 10-1. Cutaway Of Door Panel Damage

3. If door has an outer panel reinforcement, break the weld.
4. Grind off the hem flange and remove the old panel.
5. Repair any damage to the inner panel.
6. Position the new outer panel over door and bend the end flange over the inner flange.
7. Spot weld outer panel reinforcement to new door panel.
8. Spot weld new hem flange to inner panel.
9. Metal finish exterior surface, paint and assembly interior trim and hardware.

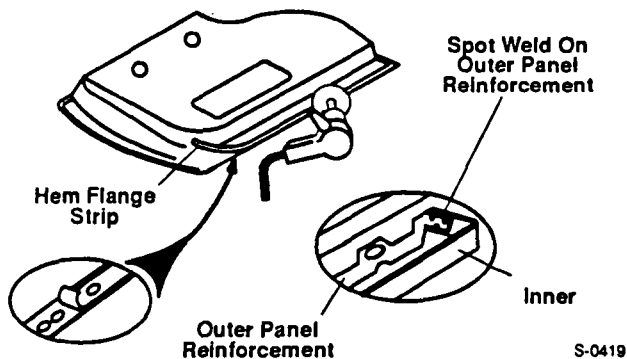


Figure 10-2. Hem Flange Removal

10-4. HOW TO PREVENT GLASS BREAKAGE AND SPATTER ON WINDOWS

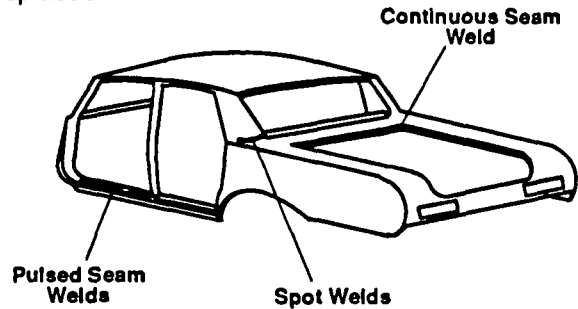
Spatter and excessive heat can become problems when welding near windows. Protect the windows by keeping them covered and as far away from the heat zone as possible. When welding must be performed near windows, the windows should be covered and protected from excessive heat by using wet rags. A putty like substance which reduces heat transfer is available through your welding supplier. If burn through and spatter become problems, ensure that the correct voltage tap is being used for the size material being welded. Use an argon and CO₂ gas mixture and check travel speed.

10-5. PROCEDURES FOR WELDING FENDERS AND QUARTER PANELS

When a complete panel must be replaced it will be necessary to remove the bolts securing the panel to the rest of the structure, or to cut through the spot welds if the panel is welded in place. In most cases a front fender will be bolted in place, while the other panels will be either spot welded or continuous seam welded. The alignment of front fenders is usually simple because the bolt holes are often elongated so that the position of the new front fender can be shifted and correctly aligned. Generally all other panels are welded into place.

If the whole panel is to be replaced, the old panel must be removed by cutting along the weld if welded by continuous seam, or by drilling out the spot welds if it is spot

welded in place. Car and body manufacturers have the panels welded in different places, so it will be necessary to inspect the body to determine where the welds are located in each case. After the old panel is removed, the inner panels must be carefully checked, straightened or replaced.



S-0420

Figure 10-3. Automotive Body Sections Assembled With Continuous Seam, Pulsed, And Spot Welds

The new outer panel can then be placed and held in position by vice-grips or c-clamp. When welding, start at the center and proceed first in one direction and then the other. In order to ensure reduced distortion due to heat, weld only a section of 2 or 3 in. (51-76 mm) at a time. It is important to constantly check the over all temperature of the sheet steel around the welding area, because it is in this concentrated heat area that warpage and distortion will begin. Leave a gap and then weld another short section. When the weld is completed it can be hammered down, filled with body putty and sanded.

10-6. WELDING FRAMES AND HIGH STRENGTH (HSS) STEELS

The new HSS steels are used on many of the new economy compact cars. HSS steels can be found in the steel gussets, brackets, floor pans, and support members of these new models. HSS steels are thinner for weight reduction and are heat sensitive. As heat is applied, the strength decreases and cracking can occur, therefore the heat affected zone must be kept as small as possible. For this reason the GMAW welding process has become the preferred method for welding HSS steels, and the oxacetylene welding or brazing processes, with its wider heat affective area, are normally not recommended.



Figure 10-4. Application Of Body Putty

SECTION 11 – PARTS LIST

SD-112 897-B

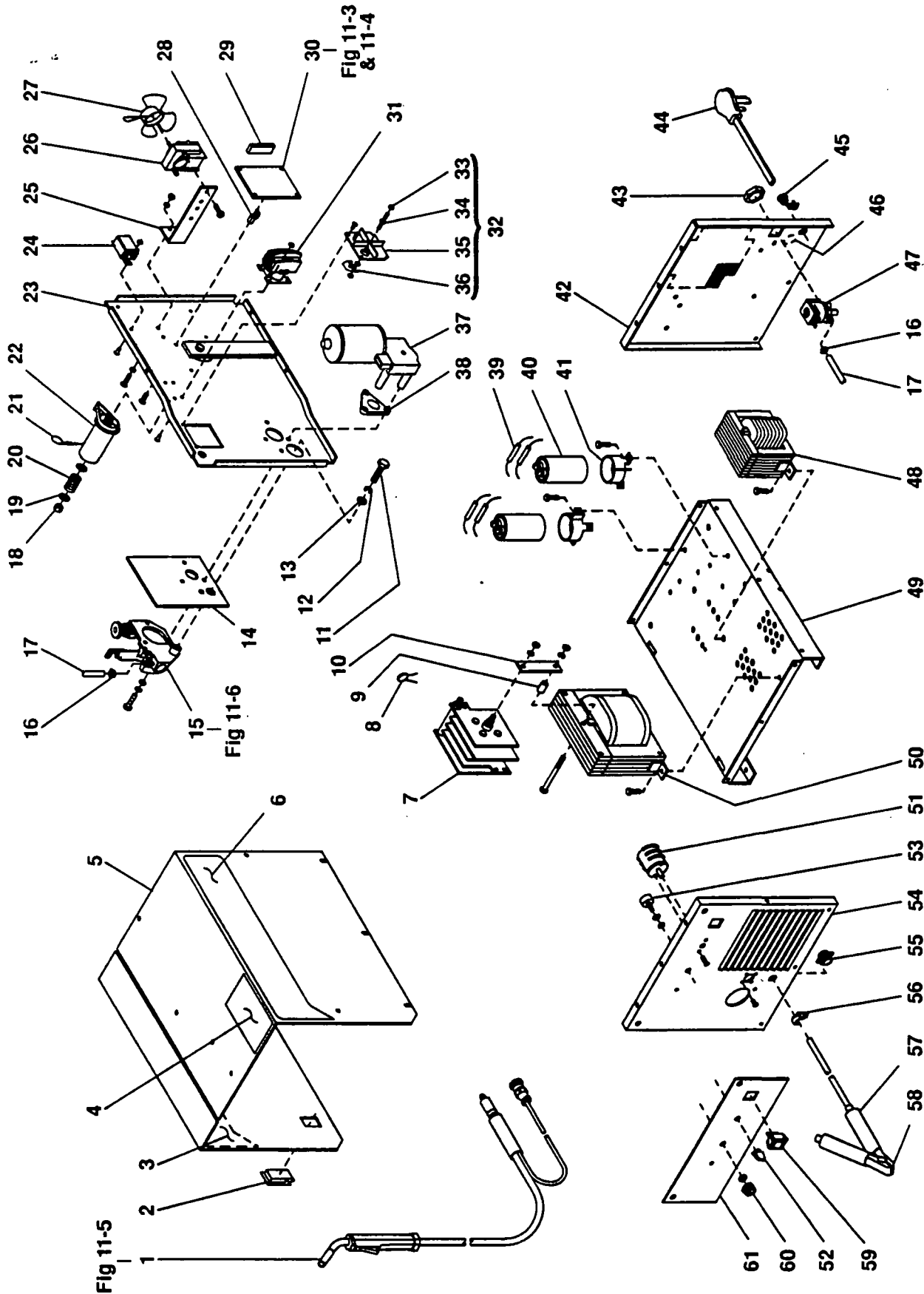


Figure 11-1. Main Assembly (Auto Arc MW 4230 Illustrated)

Item No.	Dia. Mkgs.	Part No.	Description	Quantity	
				Model	
				MW 4110	MW 4230
Figure 11-1. Main Assembly					
1		110 720	GA-16C GUN, (Fig 11-5)	1	1
2		089 899	LATCH	2	2
3		112 814	LABEL, Auto Arc MW 4110 (left side)	1	
3		127 738	LABEL, Auto Arc MW 4230 (left side)		1
4		134 464	LABEL, warning general precautionary	1	1
5		+111 833	WRAPPER	1	1
6		112 813	LABEL, Auto Arc MW 4110 (right side)	1	
6		127 991	LABEL, Auto Arc MW 4230 (right side)		1
7	SR2	119 263	RECTIFIER, si diode (consisting of)	1	
	TP1	601 066	· THERMOSTAT, NC open 167F close 140F	1	
7	SR2	124 062	RECTIFIER, si diode (consisting of)		1
	TP1	117 275	· THERMOSTAT, NC open 186F close 166F		1
8	VR1	087 156	VARISTOR, 10 joule 68VDC	1	1
9		010 124	TUBING, stl .500 OD x .17ga wall x 1.250	1	
9		010 529	TUBING, stl .625 OD x .156 wall x .875		1
10		113 447	FOOT, mtg stab	1	1
11		604 657	SCREW, cap stl hex hd .375-16 x 1.250	1	1
12		602 213	WASHER, lock stl split .375	1	1
13		010 910	WASHER, flat stl SAE .375	1	1
14		111 912	INSULATOR, housing drive	1	1
15		Fig11-2	DRIVE ASSEMBLY, wire	1	1
16		089 120	CLAMP, hose .375-.450 clp dia slftrng	2	2
17		604 550	HOSE, nprn brd No. 1 (order by ft)	3ft	3ft
18		010 909	NUT, stl slfkg hex .375-16	1	1
19		010 910	WASHER, flat stl SAE .375	2	2
20		073 355	SPRING, cprsn .625 OD x .093 wire x 1.000	1	1
21		111 998	PIN, cotter hair .120 x 2.375	1	1
22		111 929	HUB, spool	1	1
23		126 839	BAFFLE, center	1	1
24	CR1	072 817	RELAY, encl 24VAC DPDT	1	1
25		108 342	BRACKET, mtg fan	1	1
26	FM	111 931	MOTOR, fan 120V 50/60 Hz 2600RPM	1	
26	FM	117 014	MOTOR, fan 230V 50/60 Hz 2600RPM		1
27		005 656	BLADE, fan 6 in 4 wg 30 deg .175 bore CW	1	1
28		110 375	STAND-OFF SUPPORT, PC card	4	4
29		113 149	HOUSING, term hdr 14 pin	1	1
		079 747	TERMINAL, contact hdr 24-18 wire	14	14
30	PC1	137 797	CIRCUIT CARD, motor control (Fig 11-3)	1	
30	PC1	137 800	CIRCUIT CARD, motor control (Fig 11-4)		1
31	CR2	129 696	CONTACTOR, def prp 25A 1P 24VAC coil	1	
31	CR2	108 358	CONTACTOR, def prp 25A 2P 24VAC coil		1
32		116 619	TERMINAL ASSEMBLY, chgov (consisting of)	1	1
33		601 835	· NUT, brs hex 10-32	8	8
34		038 887	· STUD, pri bd brs10-32 x 1.375	4	4
35		116 620	· TERMINAL BOARD, chgov	1	1
36		038 618	· LINK, jumper term bd pri	2	2
37	M	090 087	MOTOR, gear 24VDC	1	1
38		112 583	INSULATOR, motor to housing drive	1	1
39	R2	117 116	RESISTOR, WW fxd 20W 50 ohm	1	
39		123 770	RESISTOR ASSEMBLY, (consisting of)		2
	R2-5	117 116	· RESISTOR, WW fxd 20W 50 ohm		2
40	C1	109 039	CAPACITOR, elctlt 46000uf 35VDC	1	
40	C1,2	123 768	CAPACITOR, elctlt 70000uf 35VDC		2
41		108 105	CLAMP, capacitor 2.500 dia	1	2
42		128 007	PANEL, rear	1	1
43		605 227	NUT, nyl hex jam .750 NPST	1	1

Item No.	Dia. Mkgs.	Part No.	Description	Quantity	
				Model	
				MW 4110	MW 4230

Figure 11-1. Main Assembly (Continued)

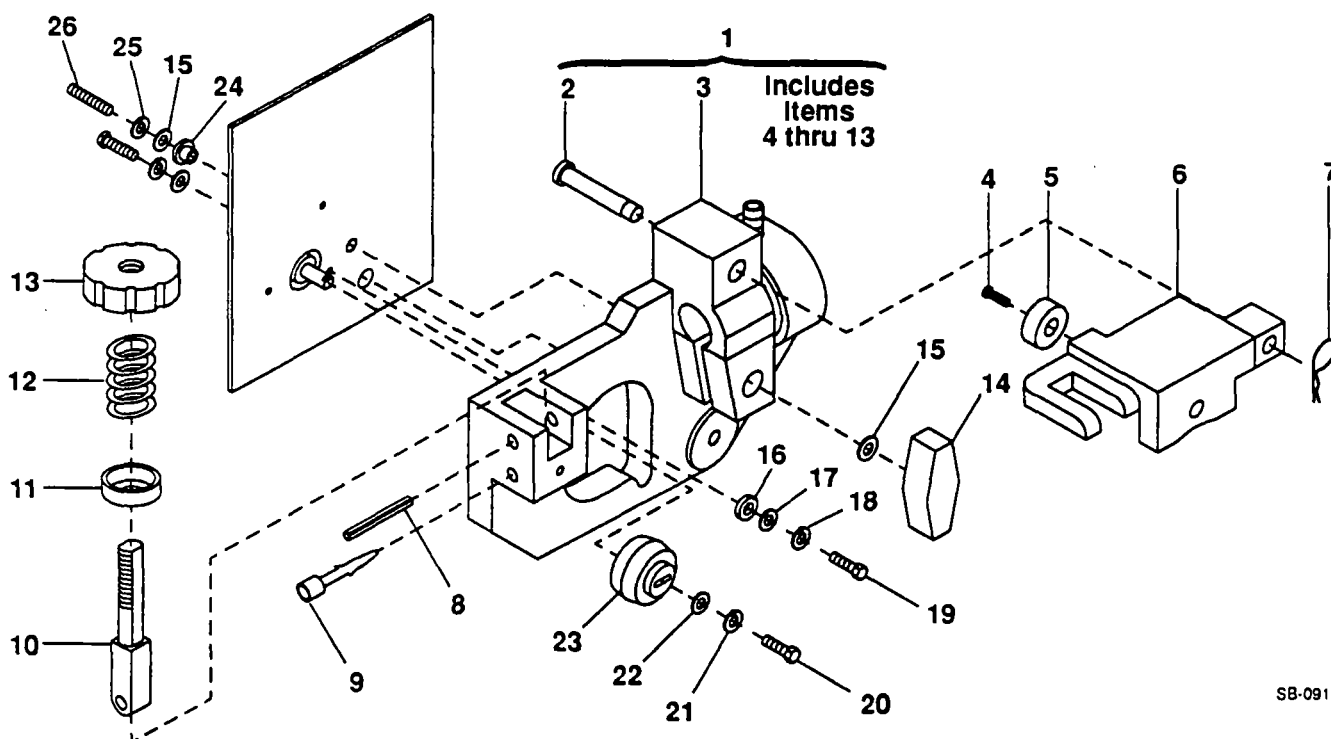
44	PLG1	113 494	CORD SET, pwr 300V 14ga 3/c 7ft	1	
44	PLG1	127 933	CORD SET, pwr 300V 12ga 3/c 6ft		1
45		111 443	BUSHING, strain relief .240/.510 ID x .875 mtg hole	1	1
46		112 811	LABEL, Auto Arc emblem	1	1
47	GS1	116 996	VALVE, 115VAC 2 way custom port 1/8 orf	1	
47	GS1	128 751	VALVE, 230VAC 2 way custom port 1/8 orf		1
48	Z	112 635	STABILIZER	1	
48	Z	123 609	STABILIZER		1
49		111 827	BASE	1	1
50	T1	113 515	TRANSFORMER, pwr main 115V (consisting of)	1	
		112 049	· COIL, pwr main	1	
50	T1	123 962	TRANSFORMER, pwr main 230V (consisting of)		1
		123 749	· COIL, pri/sec		1
51	S1	111 897	SWITCH, rotary (consisting of)	1	1
52		127 023	· KNOB, pointer	1	1
53	R1	072 623	POTENTIOMETER, C sltd sft 1/T 2W 1000 ohm	1	1
54		111 831	PANEL, front	1	
54		116 835	PANEL, front		1
55	RC3	048 282	RECEPTACLE w/SOCKETS, (consisting of)	1	1
		079 534	· TERMINAL, female 1skt 14-18 wire	4	4
56		111 644	BUSHING, strain relief .370/.430 ID x .875 mtg hole	1	1
57		026 843	INSULATOR	2	2
58		010 368	CLAMP, grd 100A	1	1
59	S2	111 997	SWITCH, SPST 10A 250VAC	1	
59	S2	116 830	SWITCH, DPST 10A 250VAC		1
60		097 922	KNOB, pointer	1	1
61		137 217	NAMEPLATE, Auto Arc MW 4110	1	
61		137 218	NAMEPLATE, Auto Arc MW 4230		1
		113 280	HOSE, gas (consisting of)	1	1
		089 120	· CLAMP, hose .375-.450 clp dia sltting	2	2
		113 129	· TUBING, PVC .250 ID x .062 wall (order by ft)	4ft	4ft
		112 863	· FITTING, adapter hose kit	1	1

+When ordering a component originally displaying a precautionary label, the label should also be ordered.
BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Part No.	Description	Quantity
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Figure 11-2. Drive Assembly, Wire (Fig 11-1 Item 15)

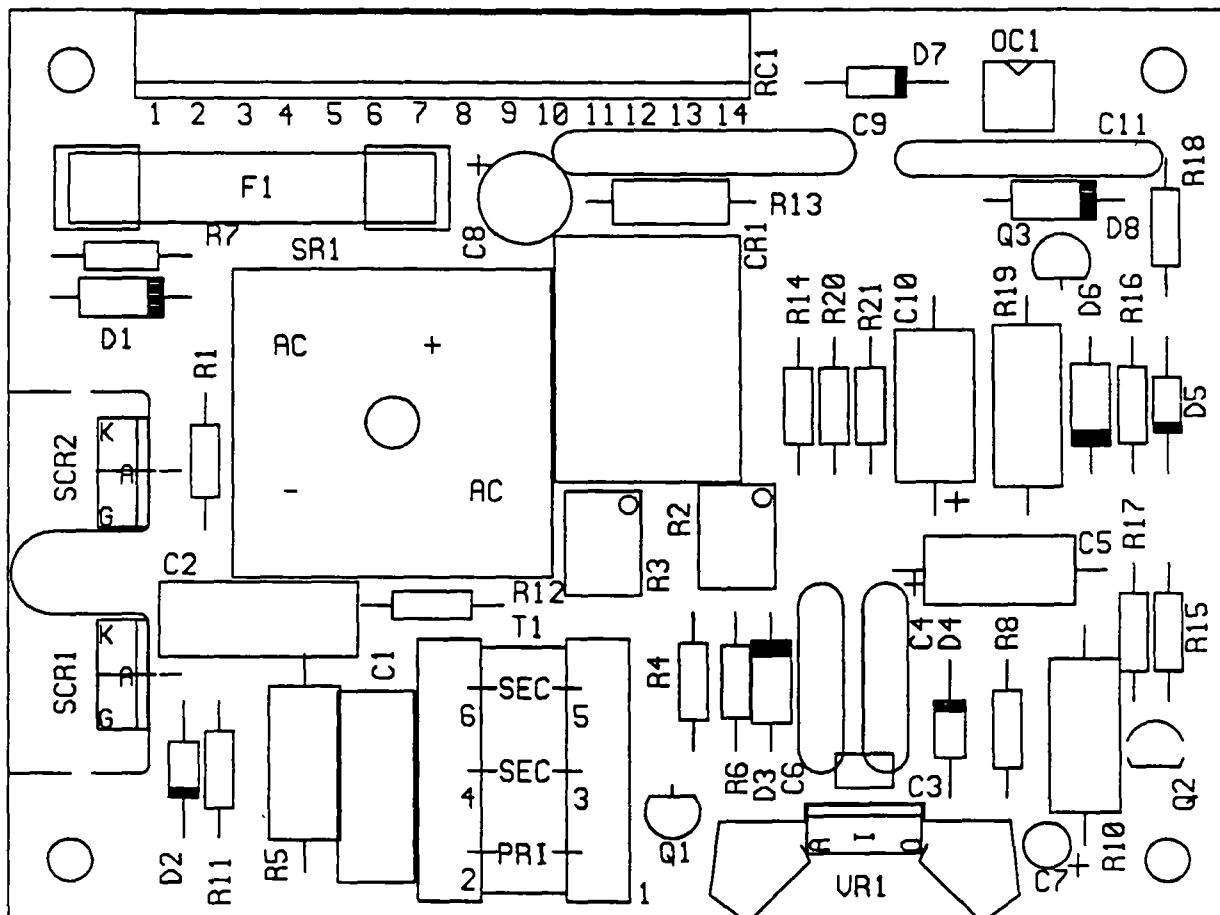
1	126 838	WIRE DRIVE, (consisting of)	1
2	090 416	PIN, hinge	1
3	124 817	HOUSING, wire drive	1
4	114 415	SCREW, mach stl phflh 10-24 x .625	1
5	111 523	BEARING, ball	1
6	112 031	LEVER, pressure roll	1
7	604 741	PIN, cotter-hair .042 x .937	1
8	010 224	PIN, spring CS .187 x 1.000	1
9	058 549	GUIDE, wire inlet 1/16	1
10	085 242	FASTENER, pinned	1
11	085 244	WASHER, cupped stl .328 ID x .812 OD x .125 lip	1
12	090 415	SPRING, compression .720 OD x 1.250	1
13	092 237	KNOB, adjustment tension	1
14	126 652	KNOB, plstc T 2.000 lg x .312-18	1
15	604 538	WASHER, flat stl SAE .312	5
16	126 653	WASHER, flat nyl .312 ID x .625 OD x .094thk	1
17	602 238	WASHER, flat-SAE 3/16	1
18	602 203	WASHER, lock-split No. 10	3
19	090 105	SCREW, cap-hex hd 5mm x 22mm	3
20	090 106	SCREW, cap-hex hd 6mm x 16mm	1
21	602 207	WASHER, lock-split 1/4	1
22	602 240	WASHER, flat-std 1/4	1
23	112 749	ROLL, drive Auto Arc U groove .023-.030 wire	1
24	126 651	WASHER, shldr nyl .437 OD x .328 ID x .703shldr	1
25	602 211	WASHER, lock stl split .312	1
26	128 129	SCREW, cap stl hexhd .312-18 x 1.750	1



SB-091 190-E

Figure 11-2. Drive Assembly, Wire

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.



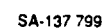
SA-137 796

Figure 11-3. Circuit Card, Motor Control PC1

Dia. Mkgs.	Part No.	Description	Quantity
PC1	137 797	Figure 11-3. Circuit Card, Motor Control (Fig 11-1 Item 30)	
C1,2	035 833	CAPACITOR, polye film .033uf 100VDC	2
C3	097 488	CAPACITOR, cer mono .15uf 50V	1
C4,6	059 122	CAPACITOR, cer disc .01uf 500V	2
C5	031 677	CAPACITOR, tantlm 5.6uf 35VDC	1
C7	000 348	CAPACITOR, tantlm .47uf 35V	1
C8	111 944	CAPACITOR, elctlt 68uf 35VDC	1
C9	044 176	CAPACITOR, cer disc .01uf 100VDC	1
C10	028 290	CAPACITOR, elctlt 1uf 50VDC	1
C11	031 670	CAPACITOR, cer disc .05uf 500VDC	1
CR1	099 018	RELAY, encl 24VDC SPDT	1
D1,3,6,8	026 202	DIODE, rect 1A 400V	4
D2	037 243	DIODE, zener 18V 1W	1
D4,7	037 084	DIODE, zener 4.7V 1W	2
D5	028 351	DIODE, sig .020A 75V	1
F1	*125 847	FUSE, mintr gl slo blo 12A	1
	089 835	CLIP, fuse 15A .250 dia	2
OC1	114 712	IC, interface 11C1	1
Q1	039 355	TRANSISTOR, UJT 15MA 40V	1
Q2	114 714	TRANSISTOR, PNP 200MA 80V	1
Q3	114 713	TRANSISTOR, NPN 500MA 80V	1
R1	092 525	RESISTOR, MF .25W 2K ohm	1
R2	009 173	POTENTIOMETER, cermet trmr 20/T .5W 5K ohm	1
R3	082 178	POTENTIOMETER, cermet trmr 25/T .5W 10K ohm	1
R4	035 825	RESISTOR, CF .25W 1K ohm	1
R5,10	004 592	RESISTOR, WW fxd 3W 150 ohm	2
R6	072 560	RESISTOR, MF .25W 1K ohm	1
R7	035 830	RESISTOR, MF .25W 6.81K ohm	1
R8	035 887	RESISTOR, CF .25W 3.3K ohm	1
R11,12	035 824	RESISTOR, CF .25W 270 ohm	2
R13	030 025	RESISTOR, C .5W 100 ohm	1
R14	035 823	RESISTOR, CF .25W 100 ohm	1
R15	039 331	RESISTOR, CF .25W 4.7K ohm	1
R16,21	035 827	RESISTOR, CF .25W 10K ohm	2
R17	039 328	RESISTOR, CF .25W 1.5K ohm	1
R18	039 334	RESISTOR, CF .25W 27K ohm	1
R19	030 843	RESISTOR, C 1W 680 ohm	1
R20	039 335	RESISTOR, CF .25W 47K ohm	1
RC1	113 148	TERMINAL, hdr 14 pin	1
SCR1,2	125 486	THYRISTOR, SCR 15A 200V	2
SR1	093 747	RECTIFIER, integ 30A 400V	2
T1	111 910	TRANSFORMER, pulse	1
VR1	093 331	IC, linear 337T	1

*Recommended Spare Parts.

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

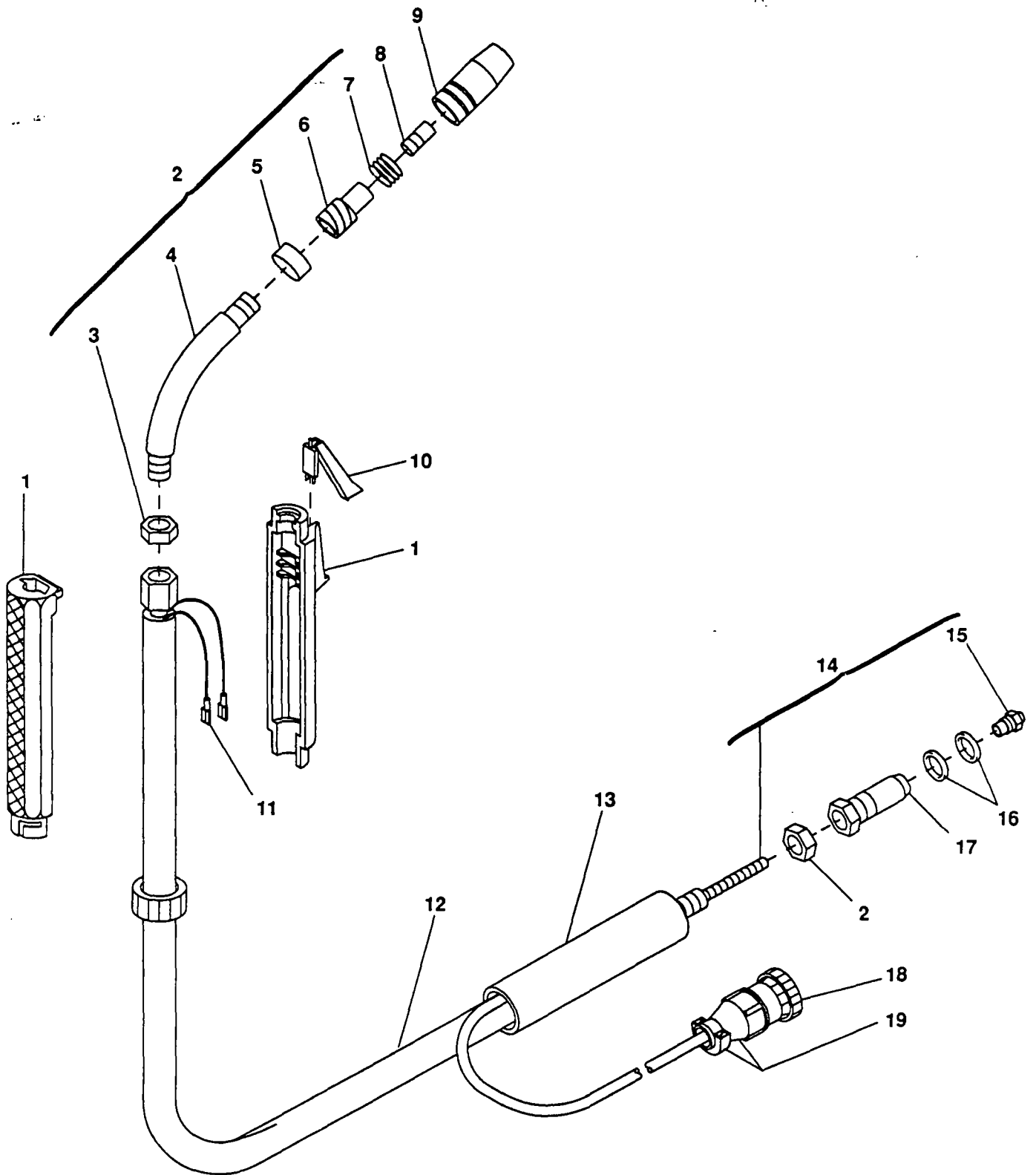


OM-112 875 Page 44

Dia. Mkgs.	Part No.	Description	Quantity
PC1	137 800	Figure 11-4. Circuit Card, Motor Control (Fig 11-1 Item 30)	
C1,2	035 833	CAPACITOR, polye film .033uf 100VDC	2
C3	097 488	CAPACITOR, cer mono .15uf 50V	1
C4,6	059 122	CAPACITOR, cer disc .01uf 500V	2
C5	031 677	CAPACITOR, elctlt 5.6uf 35VDC	1
C7	000 348	CAPACITOR, tantlm .47uf 35V	1
C8	111 944	CAPACITOR, elctlt 68uf 35VDC	1
C9	044 176	CAPACITOR, cer disc .01uf 1000VDC	1
C10	028 290	CAPACITOR, elctlt 1uf 50VDC	1
C11	031 670	CAPACITOR, cer disc .05uf 500VDC	1
CR1	099 018	RELAY, encl 24VDC SPDT	1
D1,3,6,8	026 202	DIODE, rect 1A 400V	4
D4,7	037 084	DIODE, zener 4.7V 1W	2
D5	028 351	DIODE, sig .020A 75V	1
F1	*125 847	FUSE, mintr gl slo blo 12A	1
	089 835	CLIP, fuse 15A .250 dia	2
OC1	114 712	IC, interface 11C1	1
Q1	039 355	TRANSISTOR, UJT 15MA 40V	1
Q2	114 714	TRANSISTOR, PNP 200MA 80V	1
Q3	114 713	TRANSISTOR, NPN 500MA 80V	1
R1	092 525	RESISTOR, CF .25W 2K ohm	1
R2	082 178	POTENTIOMETER, cermet trmr 25/T .5W 10K ohm	1
R5,10	004 592	RESISTOR, WW fxd 3.25W 150 ohm	2
R6	072 560	RESISTOR, MF .25W 1K ohm	1
R7	035 830	RESISTOR, MF .25W 6.81K ohm	1
R8	035 887	RESISTOR, CF .25W 3.3K ohm	1
R11,12	035 824	RESISTOR, CF .25W 270 ohm	2
R13	030 025	RESISTOR, C .5W 100 ohm	1
R14	035 823	RESISTOR, CF .25W 100 ohm	1
R15	039 331	RESISTOR, CF .25W 4.7K ohm	1
R16,21	035 827	RESISTOR, CF .25W 10K ohm	2
R17	039 328	RESISTOR, CF .25W 1.5K ohm	1
R18	039 334	RESISTOR, CF .25W 27K ohm	1
R19	030 843	RESISTOR, C 1W 680 ohm	1
R20	039 335	RESISTOR, CF .25W 47K ohm	1
R22	039 106	RESISTOR, CF .25W 470 ohm	1
R23	009 173	POTENTIOMETER, cermet trmr 20/T .5W 5K ohm	1
RC1	113 148	TERMINAL, hdr 14 pin	1
SCR1,2	125 846	THYRISTOR, SCR 15A 200V	2
SR1	093 747	RECTIFIER, integ 30A 400V	2
T1	111 910	TRANSFORMER, pulse	1
VR1	093 331	IC, linear 337T	1

*Recommended Spare Parts.

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.



SC-110 832-C

Figure 11-5. Exploded View Of GA-16C Gun

Item No.	Part No.	Description	Quantity
110 720 Figure 11-5. Exploded View Of GA-16C Gun (Fig 11-1 Item 1)			
1	110 793	HANDLE ASSEMBLY	1
2	110 795	TUBE, head (consisting of)	1
3	110 780	NUT, M 10 x 1	2
4	110 779	JACKET, head tube	1
5	110 781	STOP, nozzle	1
6	128 878	ADAPTER, head tube/nozzle	1
7	110 782	SPRING, nozzle	1
8	112 743	TUBE, contact Auto Arc .024 (.06 mm)	3
9	112 747	NOZZLE, Auto Arc 1/2 orf	1
10	110 794	TRIGGER SWITCH ASSEMBLY	1
11	080 565	TERMINAL, frict fem .110 x .016 22-18 wire	2
12	110 792	CABLE/CONDUIT, 10ft	1
13	110 797	SLEEVE, rbr	1
14	112 745	LINER, Auto Arc 10ft (consisting of)	1
15	110 784	COLLET, liner .023-.030 wire	1
16	079 974	O-RING, .500 ID x .103 CS rbr	2
17	110 796	CONNECTOR, gun/feeder	1
18	079 878	HOUSING PLUG & PINS, (consisting of)	1
	079 535	TERMINAL, male 1 pin sz 16 18-14 wire	4
19	048 834	CLAMP, cable strain relief	1

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